The Dock and Harbour Authority

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Editorial Comments

Port of London Improvements.

London, " facile princeps " among ports of Europe and, indeed, throughout the whole of the Eastern Hemisphere, with a long and eventful history dating back almost to the commencement of the Christian era, continues to maintain its prestige and importance through the passing years by exhibiting a vigorous expansion in trade which is truly remarkable. Over 60,000 vessels with a net registered tonnage of 62,151,310, arrived at the port and departed during last year, as compared with a tonnage of 28½ millions at the time when the Authority was formed, a little over a quarter-of-a-century ago. This represents some 16% of the whole port shipping traffic of the United Kingdom. The tonnage of goods handled over the quays and wharves amounted to more than forty millions. Measured in terms of value, the foreign trade of the port, including imports and exports, but not transhipments under bond, totalled £466,724,261 in 1935. Finally, as regards passenger traffic, over 230,000 travellers annually use the port for the purpose of passing to and from places outside the British Isles.

With records so impressive and satisfying from an economic point of view, it is not surprising that the Port Authority feel themselves justified in continuing the policy of port development which they have adopted in the past. As was announced in these columns some few months back, they have embarked on a further programme of improvement works which will have the effect of bringing some of the older docks into line with modern standards of shipping accommodation, and will render them more completely suitable for handling the volume of trade which arrives at their quays.

We are glad, therefore, through the courtesy of Sir David Owen, the General Manager of the Authority, to have the opportunity of presenting to our readers a fully descriptive account of the work now in hand at the Royal Victoria and Royal Albert Docks and at the India and Millwall Docks. The range of operations indeed, is so widespread, that it has been found necessary to divide the article with its numerous explanatory diagrams and photographs into two parts, the first of which, dealing with the Royal Victoria and Royal Albert Docks, appears in this number and forms the subject of our illustrated supplement.

It has often been the subject of remark that the ordinary inhabitant of London knows little of the port which lies at his doors and upon which he is so dependent for the food and commodities which he consumes and uses. This reproach is gradually being removed by the enterprising action of the Port Authority, who have inaugurated and maintained during the summer months a service of vessels by which a comprehensive tour may be made of the various dock systems, so that anyone who wishes to do so, may obtain a very representative idea of the working of a great port.

This is all to the good, for it is eminently desirable that, in these enlightened days, the public should be fully aware of the great and momentous interests at stake when reckless projects and subversive movements are promoted by misguided enthusiasts. The trade of the port is a great and valuable asset to the nation as a whole, and anything which tends to disturb its delicate balance would inflict injury of a far-reaching kind.

We cannot conclude this comment without a reflection, hazy perhaps and indefinite, on the possibilities of the future. London, of course, is a great emporium and entrepôt port. Its importations are largely for local consumption and manufacture. Moreover, the metropolis continues to grow in size and population, and the growth during the past few years has been very striking. According to Sir Montague Barlow, a former Minister of Labour, the increase in London's population during the ten or twelve years before 1933 was a million-and-a-quarter, that is, as much as the increase in the whole of the remainder of Great Britain. The statement is arresting, and in a certain sense, alarming. Is the momentum of the machinery gaining at such a rate as to threaten some gigantic breakdown? The question may, at first sight, appear fanciful, but a little reflection will show that it cannot be lightly dismissed. The concentration of population in the vicinity of London, while other parts of the country are being seriously denuded, is a disturbance of equilibrium which is fraught with the possibility of untoward consequences.

The Port of Bordeaux and the Gironde Estuary.

We commence this month the publication of a series of articles translated from the French of the monograph by Monsieur François Lévêque, Director of the Port of Bordeaux, on the formation of the new navigable entrance channel to the Gironde Estuary.

The new channel, known as La Grande Passe de l'Ouest, or Great West Channel, has been in part dredged through the exterior bar of the Estuary, locally called the Great Bank. It takes the place of the old natural channel, the Passe des Charentais, or North Pass, which served as the principal route of entry to the port for more than a century. This channel, besides other defects, was not stable in direction or position, as it tended to acquire a north and south bearing, and to shift dangerously near the north side of the mouth of the Gironde. More objectionably still, its available depth of water decreased within the short period of two years by 8-ft. and the Port of Bordeaux was threatened with ultimate closure.

Making temporary use of a secondary channel, the Passe du Matelier, the problem of providing an adequately direct and convenient entrance to the estuary was painstakingly studied and eventually solved in the manner indicated. Thanks to skilful treatment of the local conditions and to the steady perseverance of Monsieur Lévêque and his staff, the passenger landing pier at Le Verdon, the outport of Bordeaux, is now approachable by the largest vessels afloat. The channel through the bar has a length of 4,500 metres (2.8 miles) and a minimum low-water depth of 9.5 metres (31-ft.) below zero of marine charts, so that, according to the nature of the tide, it is traversable by the " Normandie " with a draught of 11.20 metres (36-ft. 9-in.) and an allowance for 'scend due to wave oscillation, of 1.50 metres (6-ft.) within periods of 6¼ hours at neaps or 6 hours at springs. The "Bremen" and the "Europa" with a draught of 9.75 metres (32-ft.) could count on a period of, at least, 7¾ hours at any tide.

Taken in conjunction with the construction of the passenger pier at Le Verdon, which provides a berthage of 300 metres (984-ft.) in length on each of its faces and a minimum depth of water alongside of 14 metres (46-ft.) on the outer face and 12 metres (39-ft.) on the inner face, the whole undertaking is a notable achievement, reflecting the highest credit on the Port of Bordeaux and its officers.

Editorial Comments—continued

Fishery Harbours and the Fishing Industry.

A very considerable number of the smaller harbours of this country are associated with the fishing industry, upon which they are dependent for their trade and receipts, and even some notable commercial ports have provided special adjuncts for the accommodation of fishing fleets. Anything, therefore, which affects the welfare of the industry is of undoubted importance to the authorities of these harbours and ports. They will have viewed with concern the depression which has overtaken the industry, and the recently issued Report on Sea Fisheries for 1936, published by H.M. Stationery Office, affords neither them, nor the fishing trade generally, much satisfaction.

The report contrasts the present depression with that of 1932, which it says could be attributed in a large measure to a wave of depression in which all industries shared, but, except for a slight improvement in 1934, the trawling industry has not participated in the general recovery since that date.

One cause of the depression is stated to be over-production. The quantities of demersal (deep water) fish landed last year were the highest ever recorded. Moreover, the cost of coal has risen sharply and this largely governs the economic situation.

The circumstances at the present time are clearly not propitious for any further increase or expansion of fishing trade facilities, and it is hardly likely that projects for the creation of new centres of the industry, such as that recently advocated at the Port of Liverpool and commented upon in our September issue, would meet with financial success.

Harbour Authorities and their Craft.

A case of no little interest and importance to Harbour Authorities is that of the proceedings at the Poole Police Court recently when the Poole Harbour Commissioners were fined for an infringement of the Merchant Shipping Act. The circumstances are related in the article on page 21 by our Legal Correspondent.

Without criticising the finding of the magistrates on the point of law involved, it does seem a little hard that a harbour authority should not be able to make use of its own craft for the purpose of an occasional pleasure outing by the members of the Board and their friends without the formality of a Board of Trade survey and licence. The vessel was admittedly safe and well-manned, and no charge of over-crowding was preferred. But the law on the subject is definite and perhaps wisely rigid, since neglect of certain elementary precautions, in the absence of official supervision, might conceivably result in disaster. The moral is that it is wise to keep on the right side of the law even in apparently unimportant matters.

Liverpool's Transhipment Trade.

There has been a considerable degree of concern exhibited recently in commercial and coastal shipping circles at Liverpool over the serious position of the transhipment trade of the port, which has been undergoing a continuous process of decline ever since the end of the War, and has now reached the stage of almost total extinction. A movement has been on foot during the past year or two to investigate the causes and endeavour to find a remedy. The Liverpool Junior Chamber of Commerce recently took the matter up and a Sub-Committee issued a report in April this year, which recounted the circumstances and discussed various means, by which in the view of the Committee, the trade might be resuscitated.

The misfortune which has overtaken Liverpool has been shared in greater or less degree by a number of other ports. Transit, or transhipment, cargoes as a whole have tended to become fewer on account of the increased number of direct shipments from points of primary production to ports of ultimate consignment, and also on account of the wider range of ports to which shipping is now sent. Moreover, as regards Liverpool, the development has been accentuated by the fact that, generally speaking, Continental port dues and labour charges are lower than at British ports, while at the same time Western Continental ports are more favourably located for deliveries to points on the East Coast and the North Sea.

It is the considered judgment of the Transport Committee of the Liverpool Chamber of Commerce, who have just reviewed the earlier report of the Junior Chamber, that the one main feature of the recent developments in the shipping industry, which is accountable for the present situation, is the practice developed during the past twenty years, and now generally adopted in shipping circles, of giving the same rates of freight to most United Kingdom and Continental ports. This, of course, puts Liverpool from a geographical point of view at a pronounced disadvantage. The Committee also call attention to the practice of discharging cargoes for various destinations at intermediate ports, where cheap storage in lighters can be secured until such time as the cargoes can be picked up by vessels of the same fleet for conveyance to their destinations by direct route.

The remedies proposed are varied and mainly concern the shipper and shipowner. As regard the province of the port autnority, the suggestion is put forward that a further reduction should be made in the dues on cargoes destined for transhipment and on goods re-shipped from the Port of Liverpool to another destination before removal from the landing quay. It seems doubtful whether this suggestion would be entertained by the Dock Board, if indeed a former decision on the point is not to be taken as final, for the Committee find themselves forced to conclude that there is " no feasible suggestion which might be expected to result in a reversion of the developments which started immediately after the War and have become consolidated as a fixed policy of the Shipping Companies."

There is one last point to which we may allude as affecting the purview of port authorities. The contention is put forward in certain quarters that the making of Liverpool into a free port would beneficially affect the situation. The Committee dismiss the suggestion on the ground that " every dock and quay in Liverpool and Birkenhead at present offers under the Customs system of the Port all the facilities that can be offered by what is known as a free port." This is undoubtedly the case, yet the idea of a Free Port as a panacea for stimulating trade continues to attract adherents. From the experience of the Port of New York Authority, however, in connection with the " Foreign Zone " on Staten Island, such zones would appear to find little support from the mercantile community. The response of private interests is described in the New York "Shipping Register " as uncertain, and it is added that " municipal authorities recently started an advertisement and poster campaign." This does not indicate any great public enthusiasm for the project.

The Quarterly Shipbuilding Returns.

The statistics issued by Lloyd's Register regarding Merchant vessels under construction at the end of September show that there is a slight decrease (15,338 tons) in the work in hand as compared with the figures for the previous quarter. The present tonnage under construction (1,184,635 tons) however, is greater than that of a year ago and it exceeds considerably the aggregate tonnage now under construction in the four leading countries abroad. There is, therefore, every reason to be satisfied with the figures which continue to reflect the prosperous condition of trade in the country.

Shipping Development and Port Restrictions.

In his presidential address to the Institute of Transport on October 11th, entitled " Engineering Limitations and Transport Ideals," Sir Alexander Gibb lightly touched on the subject of shipping and shipbuilding, and remarked that " so far as the size of ships is concerned, there is no existing limit except the physical disabilities of the ports to which the ships have to operate." He did not discuss the nature of these physical disabilities nor make any suggestion for their treatment, although it can be imagined that what he had in view was the depth of water in the entrance channel and approaches of the port, since in other respects Port Authorities are practically able to meet the most exacting requirements of present day vessels. It was Sir Alexander's view that shipbuilding design needed material modification, if possible, in the direction of greater speed at lower cost. He pointed out that improvements in hull design and, even more, improvements in the method of propulsion, would have a considerable effect in securing this.

London Public Wharfingers.

It will be a matter of interest in wharf and warehouse circles in the Port of London to learn that a Federation of London Public Wharfingers has just been formed to promote the interests of those engaged in this class of business, and " to uphold the accepted principles of freedom of private enterprise in the port."

The movement has originated in consequence of the action of the Port Authority in announcing their intention to promote a Bill in Parliament for the registration of public wharfingers and up-town warehouse keepers. Whether this step is in the general interests of the port is a matter about which the wharfingers themselves are not at all convinced, and as will be seen from our report on page 8 of the meeting held to hear Sir David Owen's explanation of the matter, very pronounced opposition was expressed to the proposals. Subsequently a general meeting of the newly-formed Federation was held to hear Sir David Owen again. At this stage, as we go to press, the matter stands without any definite decision until the Federation have given it full consideration. It is only to be expected that a proposal of such a far-reaching character, involving an obligation upon the wharfinger to pay standard wages and to make standard charges, would meet with considerable reluctance on the part of those whose freedom of action would thereby be curtailed.

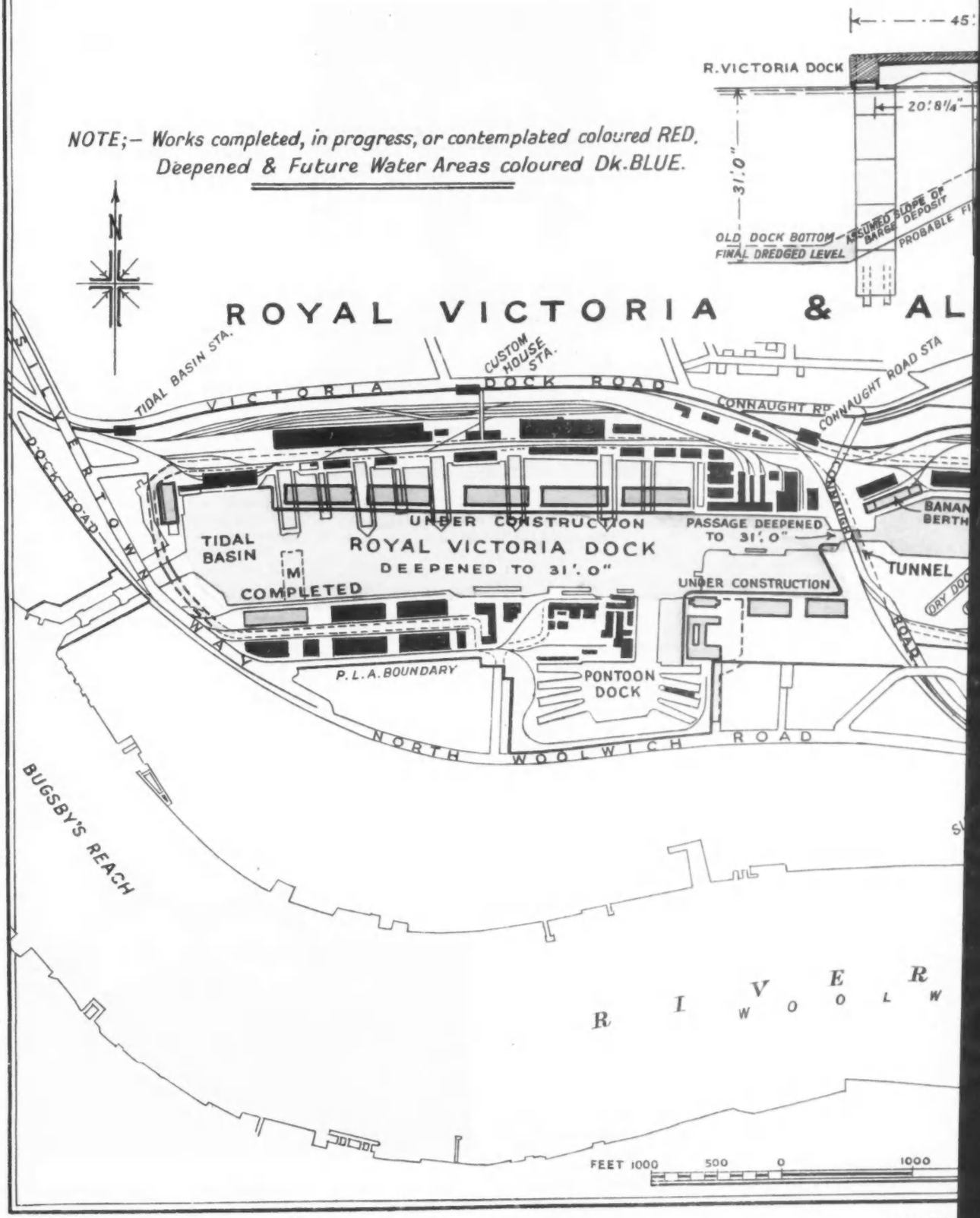
DOCKS MODERNIZATION SCHEMES FOR THE

PORT OF LONDON.

(P A R T 1.)

GENERAL MANAGER TO THE PORT OF LONDON AUTHORITY;—SIR DAVID OWEN.

CHIEF ENGINEER;—ASA BINNS Esq., M.Inst. C.E..



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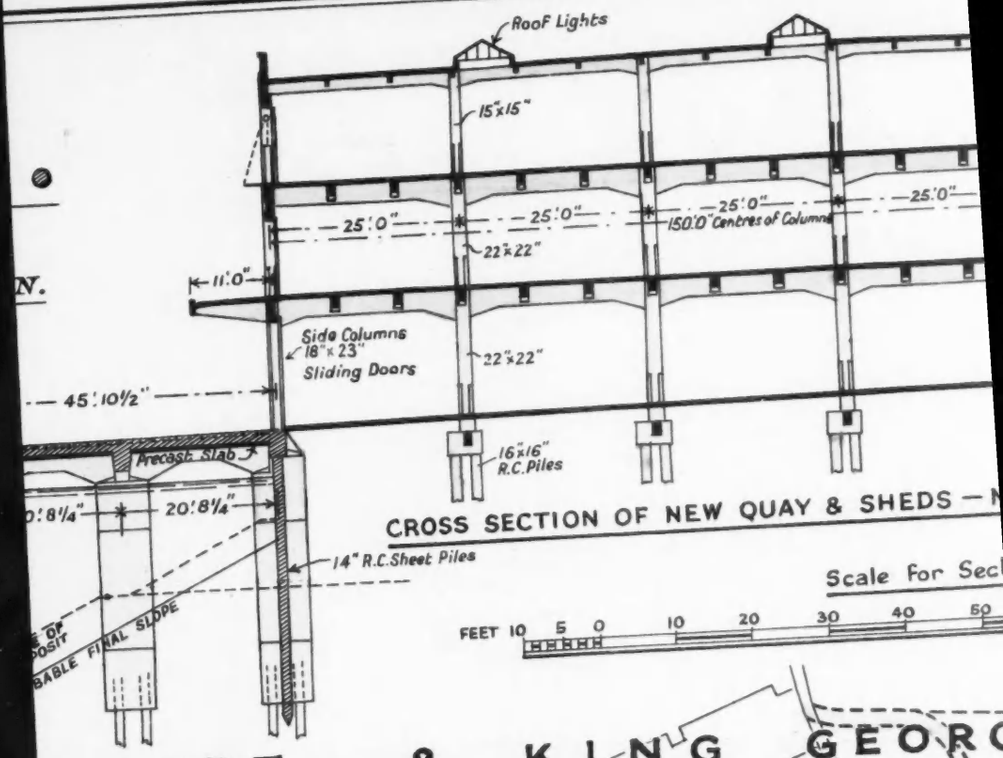

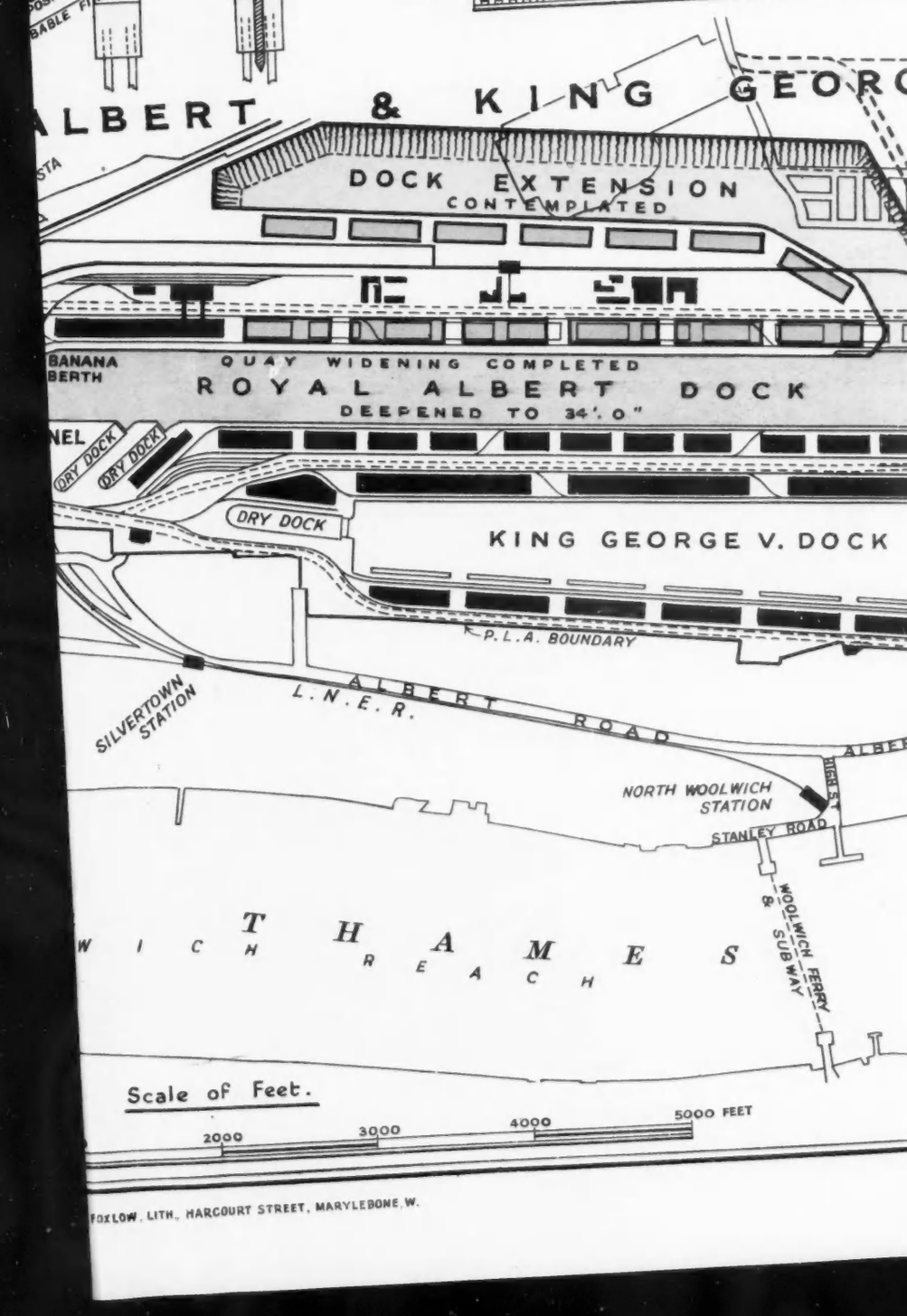

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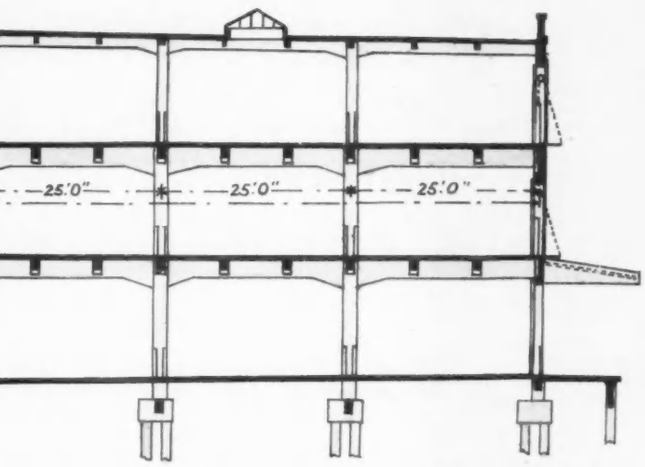

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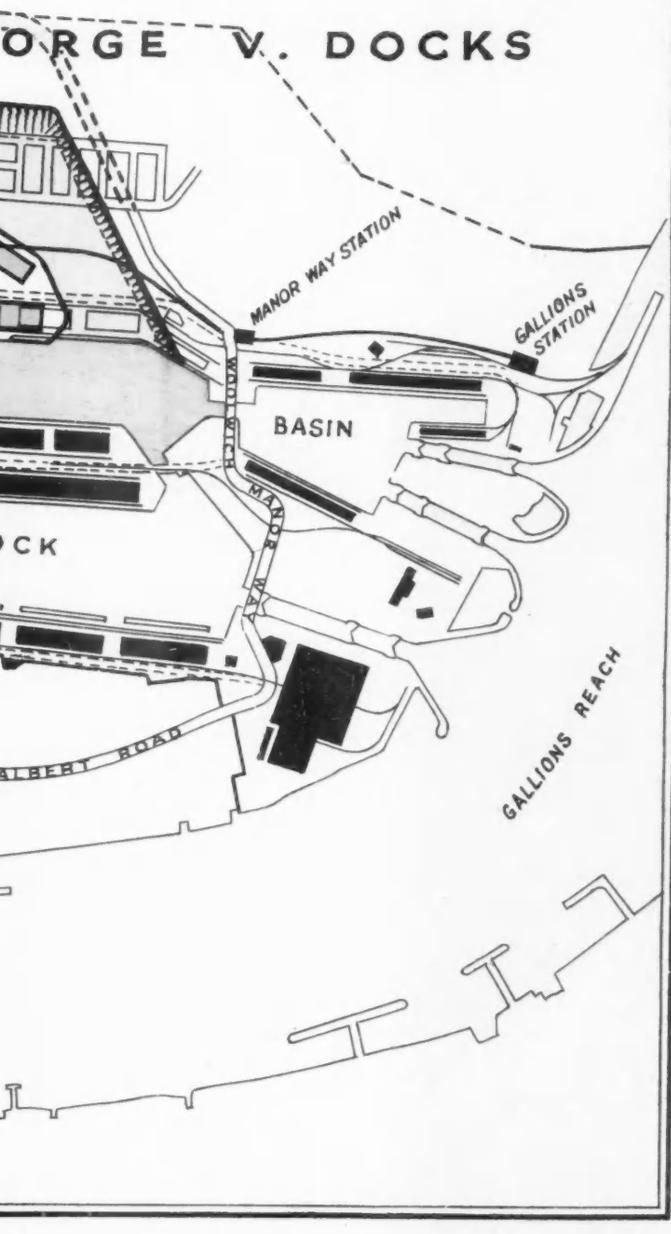


Port of London Developments

An Account of Important Improvement Schemes in hand

By Sir DAVID J. OWEN, General Manager, Port of London Authority

TO survey the history, growth and development of the Port of London provides a subject of the greatest interest, if not fascination, for any student. There is no doubt that from very early times London had become a trading centre, and what we know as the Pool of London was a haven giving safe anchorage for vessels carrying the merchandise by water. Much as the developing trade of London of those times must have owed to the River Thames and the vessels that came in from the sea, it is no exaggeration to say that never in all its history was London so dependent as it is today upon the shipping and commerce using its docks and river for its prosperity and pride of place among the cities of the world.

The Trade of the Port

The phenomenal growth of the trade of the port during the last two centuries is indicated by the undernoted figures:—

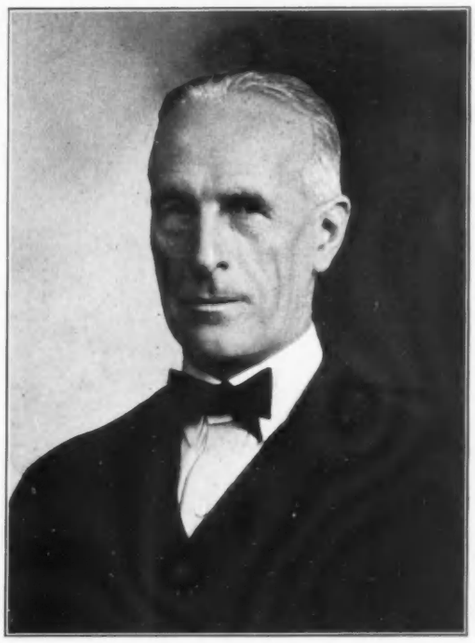
Year	Net registered tonnage of vessels that used the Port, Foreign and Coastwise, Entered and Cleared
1700	651,529
1750	1,159,892
1794	2,523,653
1860	9,507,608
1900	30,500,437

The Port of London Authority was created in 1909, and the following table illustrates the progressive increase in the volume of shipping using the port since that date, the upward trend being deflected only during two periods of national extremity, viz., during the Great War, including the subsequent recovery years and during the period of trade depression a few years ago which the shipping business felt so acutely.

Year ended 31st December	N.R.T. of Vessels that arrived at and departed from the Port of London, foreign and coastwise, with cargoes and in ballast	Per cent. of London to total United Kingdom tonnage
1909	38,510,989	12.9
1913	40,080,282	12.0
1918	14,564,008	11.9
1922	39,293,139	13.3
1926	49,278,173	17.8
1930	58,085,598	15.9
1934	58,947,642	16.2
1936	62,168,833	17.1

In terms of net register tons, therefore, the shipping entering the port has increased during the life of the Authority by 61.4 per cent. At the same time, as the above figures show, London is receiving an increasing proportion of the total tonnage arriving at and departing from all United Kingdom ports.

Vaults under former Victoria Dock Jetties, in course of demolition.



Photo] [Vandyk

The Right Hon. LORD RITCHIE of Dundee, Chairman of the Port of London Authority

Owing to the absence of reliable figures, it is not possible to compare figures of the tonnages of goods passing through the port prior to 1930, but in that year the tonnage of goods imported into and exported from the Port of London, foreign and coastwise, including transhipments, was 36,440,776, whereas during the year ended 31st March, 1937 the figure was 42,871,678 tons, an increase during this period of 17.6 per cent.

Although it will be obvious that any figures of cash value because of fluctuations due to various causes, are not necessarily a true reflection of the state of trade, the statement below of the value of London's trade, compared to the total trade of the United Kingdom, is of interest, and provides evidences in another form of London's immense debt to its river, and of its huge share of the total sea-borne trade of the country.

Year ended 31st December	Value of Overseas Import and Export Trade (excluding transshipments under bond)		Per cent. of London to total United Kingdom
	United Kingdom	London	
	£	£	
1909	1,094,230,123	322,614,363	29.5
1913	1,403,555,065	411,792,149	29.3
1918	1,848,514,981	541,909,302	29.3
1922	1,826,300,979	564,333,772	30.9
1926	2,019,903,154	701,606,122	34.7
1930	1,701,566,086	603,742,464	35.5
1934	1,178,642,651	444,924,748	37.7
1935	1,237,177,584	466,724,261	37.7

It was with the task of improving the accommodation and facilities of the river and docks that the Authority were entrusted on their formation in 1909. It will be appreciated that while the Authority own the five large dock systems, they have conservancy powers only in regard to the river, except in the case of their own riverside properties.

The enormous figures of London's trade which have been quoted, will give an idea of the problems with which the Authority have to deal. From time to time certain of the larger improvement works undertaken by the Port of London Authority have been dealt with in this publication, and the issue of July last contained a brief historical survey of events leading up to the formation of the Authority, and their efforts to carry out the responsibilities entrusted to them, concluding with a reference to the modernisation and development scheme, estimated to cost £12,000,000, which the Authority approved in principle last year as necessary in the course of the near future to keep abreast of the advancing requirements of London's water-borne trade.

The scheme is divided into stages, in order of the urgency of the various items. A commencement has already been made on some of the more urgent works included in the first stage of the scheme and their location as well as the other improvements referred to later, may be seen by reference to the map of the docks contained in the illustrated Supplement. It is anticipated that other items in this stage will follow during the next year or so, while the succeeding stages will be undertaken from time to time, as financial and other circumstances permit.

The "Royal" Dock System

Only a mere outline has been given of a few of the works included in the first stage of the programme, and it may be of interest, therefore, to set out a more detailed explanation of certain of the items which have already been put in hand; it is proposed to refer, particularly in the first section of this article, to those in the Royal Victoria, Albert and King George V. Docks. These docks are the heart of the port, with the obvious advantage of a situation close to the centre of distribution, excellent road access to the markets of the Metropolis and rail connections to all parts of the country.

They are the most extensive of the dock systems, and handle the greatest volume of London's overseas trade.

It is therefore natural that the main schemes of development and expansion, at the inception of the Authority, were concentrated at this system. Amongst the major works carried

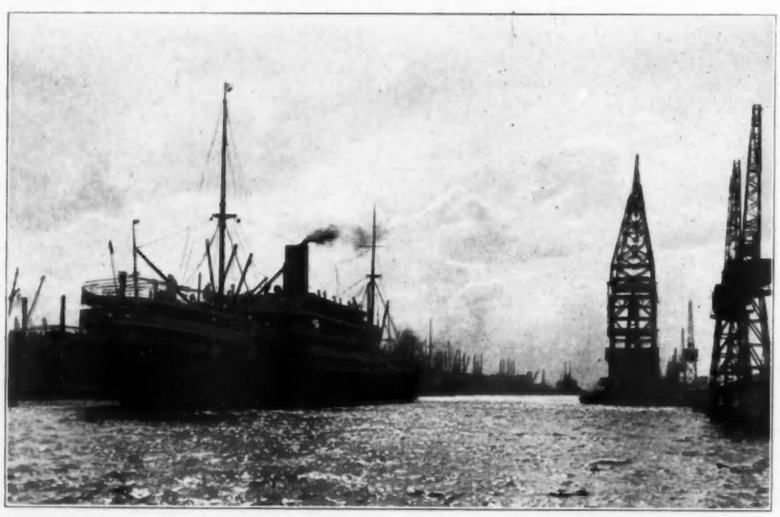
Port of London Developments—continued

Widening of North Quay, Royal Albert Dock, showing decking in construction on cylinders.

out were the construction of a wet dock—the King George V. Dock—together with a dry dock and the provision of a new cold store and berths specially equipped for dealing with the frozen and chilled meat trade.

It would be as well, before dealing with the works included in the present scheme, to mention some further very significant improvements which were already in hand at this group of docks. Firstly, by reason of the increasing size of liners using the Royal Albert Dock, it was found that the existing depth of water was becoming insufficient. This dock was opened in 1880, and it is interesting to recall that it was one of the first large undertakings to be lighted by electricity to enable work to be carried on by night as well as by day.

Owing to the method of construction of the dock, it was not possible to provide a greater depth near the quay than 29-ft. 6-in. A false quay was therefore constructed 19-ft. wide and extending for a length of some 5,350-ft. at the north side of the dock; and by dredging outside this quay, a depth of 34-ft. has been achieved, which can later be still further increased if necessary. The cost of this work was £131,000. The false quay consists of a reinforced concrete decking carrying crane and railway tracks, supported by concrete cylinders planted below the dock bottom. This method, under the conditions prevailing, is economical, and permits of considerable speed of construction. The whole quay, commenced from both ends simultaneously, was completed within 40 weeks. In the second portion of this article dealing with the other groups of docks, it is proposed to give technical details of this type of quay construction of more recent execution.



Shipping in the Royal Albert Dock.

Railway Tunnel Reconstruction

Access to the Royal Victoria Dock for vessels is from the Royal Albert Dock, via Connaught Road Passage, under which runs the London and North Eastern Railway to Silvertown. Hitherto, the presence of the railway tunnels has restricted the depth of the Passage to 28-ft., which has consequently determined the maximum draft of vessels that could be berthed in the Royal Victoria Dock, and this problem had to be dealt with before any scheme of development at the Royal Victoria Dock to meet the needs of larger vessels could be contemplated. By arrangement with the Railway Company, the position has been met by lowering the railway lines and deepening the cutting by 3-ft. This has cost the Authority £70,000, and was a work that called for careful handling. Fortunately, beneath the dock passage the railway lines were in twin tunnels, and this fact facilitated the operations, as it was possible to deal with one tunnel at a time and work traffic as a single line in the other; but, during the peak hours of the passenger traffic, use had to

Port of London Developments—continued

be made of the Port Authority's high-level railway over the swing bridge crossing the passage, the bridge being previously strengthened by electric welding to permit of the passage of locomotives of greater weight than the bridge generally carries. The illustration shows a cross section of the twin tunnels. The brickwork, originally 4-ft. 6-in. thick at the crowns, has been reduced to 1-ft. 6-in., and to enable this to be done, the tunnels were lined with cast-steel rings, 2-ft. wide, built up in bolted flanged segments; the brickwork of the tunnels was, in the first instance, trimmed in short lengths at a time to the profile of the steel lining, with a margin of 1-in. for grouting space.

The metal, being $1\frac{1}{8}$-in. thick in the skin and flanges, complied with the requirements of the British Standard specification of 26/35 tons per sq. in. tensile strength. The circumferential and longitudinal joints were machined to the full depth of the flanges, and the bolt holes were drilled after machining and countersunk for cast-lead washers.

After erection the rings were grouted, usually three at one time, with neat cement under pressure, and finally all joints were electrically seam welded.

A cast-iron lined subway, 8-ft. in diameter, was driven under the passage from similarly lined shafts, 14-ft. in diameter.

The shafts and subway were constructed under compressed air and accommodate the electricity, water, gas and hydraulic power services diverted from culverts adjacent to the railway tunnels. The brickwork surrounding these culverts was eventually broken up by a "Lobnitz" rock breaker, and removed by a bucket dredger.

The projecting toe of the side walls of the passage was trimmed off by helmet divers, but, as they could make very little progress in removing the brickwork arches over the railway tunnels, the diving bell 10-ft. 5-in. by 6-ft. 6-in. and 6-ft. 6-in. in height, shown in the illustration, was specially built for the purpose. A crew of four men manned the bell, which was equipped for working three compressed-air picks; electric lighting and a telephone were also installed. The bell was slung from one of the Port Authority's floating cranes, and the compressed air was supplied from the neighbouring dry dock. The brickwork was removed in three layers by the bell; frequent interruptions occurred for the passage of shipping.

Flour Mills, Royal Victoria Dock.

Royal Victoria Dock Improvements

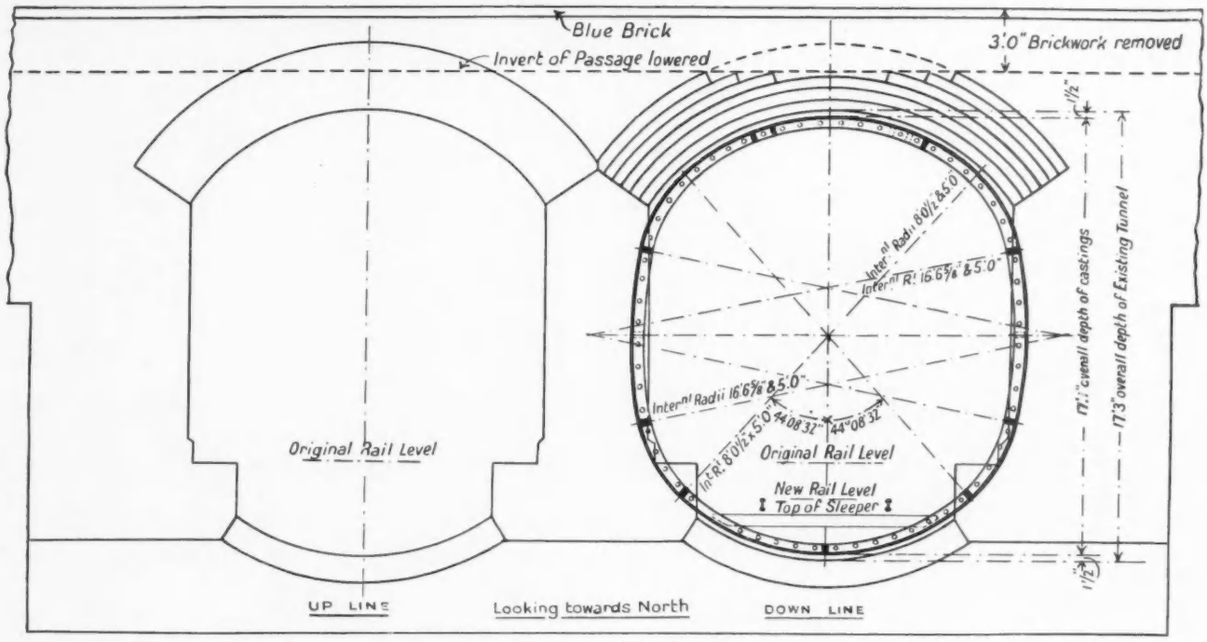
At the western end of the Royal Victoria Dock, the solid jetty on the south side which separated the Tidal Basin from the main dock has been dredged away, and the old timber wharfing and campshedding has been replaced by a reinforced concrete quay, which has been extended into the former basin, making up a total length of 1,750-ft. of new quay. This quay is also of reinforced concrete, built up on concrete cylinders sunk through the shelving bottom of the dock, with concrete sheet piles driven at the back to retain the ground.

In this case the quay is anchored by tie beams to the foundations of existing quayside sheds, and, for the extended portion, the quay anchorage was incorporated in the foundations of a new three-storey warehouse 504-ft. by 120-ft., built of reinforced concrete framework, floors and flat roof, with brickwork panels, in which are installed one-ton luffing electric wall cranes and two ton lifts. These works and the warehouse with crane equipment, roads and railways, cost some £270,000.

As already mentioned, these improvements were already in hand at the time of the preparation of the new scheme, and the costs are not therefore included in the total figure of £12,000,000.

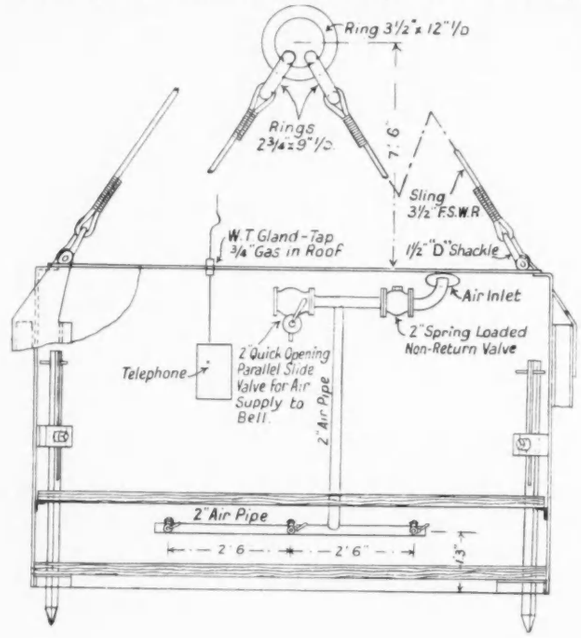
New Reinforced Concrete Quay, South Side of Royal Victoria Dock. Fixing of Pre-cast Beams to receive Concrete Deck.

Port of London Developments—continued



Cross-section of the Twin Tunnels.

The most comprehensive work planned in the new scheme and already well in hand, is the development of the Royal Victoria Dock. This dock owed its origin to the need that arose, in the middle of the nineteenth century, for docks capable of accommodating the larger types of vessels which were then being constructed, consequent upon the development of steam propulsion in the place of sails. It was constructed in 1855, and was the first dock in the port to be connected directly with the main line railway systems, and also the first to be equipped with hydraulic power for operating the machinery. The north side of the dock was developed on a different plan from all the other docks in the port, the quays consisting of piers built out into the dock at right angles to the land and carrying warehouses, or transit sheds. At the south side, a considerable area of land was left vacant as pastures, in anticipation of a large traffic in live cattle from North America. This traffic, however, did not eventuate.



The Diving Bell.

Most of the jetties still remained until recently, but it was realised that they were past fulfilling their original purpose. With the increase in the size of the modern vessel, the jetties were inadequate to deal at one time with the cargoes of vessels lying on each side of the jetties, and thus only one-half of the lineal quayage was effective. The jetty structures were too frail to accommodate heavy pieces, or packages of cargo, and the working costs were high, owing to the fact that goods had to be conveyed for comparatively long distances to and from railway trucks and road vehicles on the mainland from and to the ships by hand, or electric trucks. There was also an element of risk both to the ships at the jetties and to those passing down the dock, when vessels overlapped the jetties. These jetties are, therefore, being swept away, some of the water area reclaimed, and a continuous quay constructed some 3,250-ft. in length, furnished with five modern three-storey warehouses. It is estimated that this work will cost £1,200,000.

On this side of the dock, where the new false quays have to be constructed in deep water, three rows of cylinders are adopted, with stiff portal beams supporting concrete sheet piling 14-ins. in thickness, for retaining the filling of the reclaimed areas.

In the Supplement is shown a typical cross section of the quay now under construction on the north side, and also, in outline, the future three-storey warehouses.

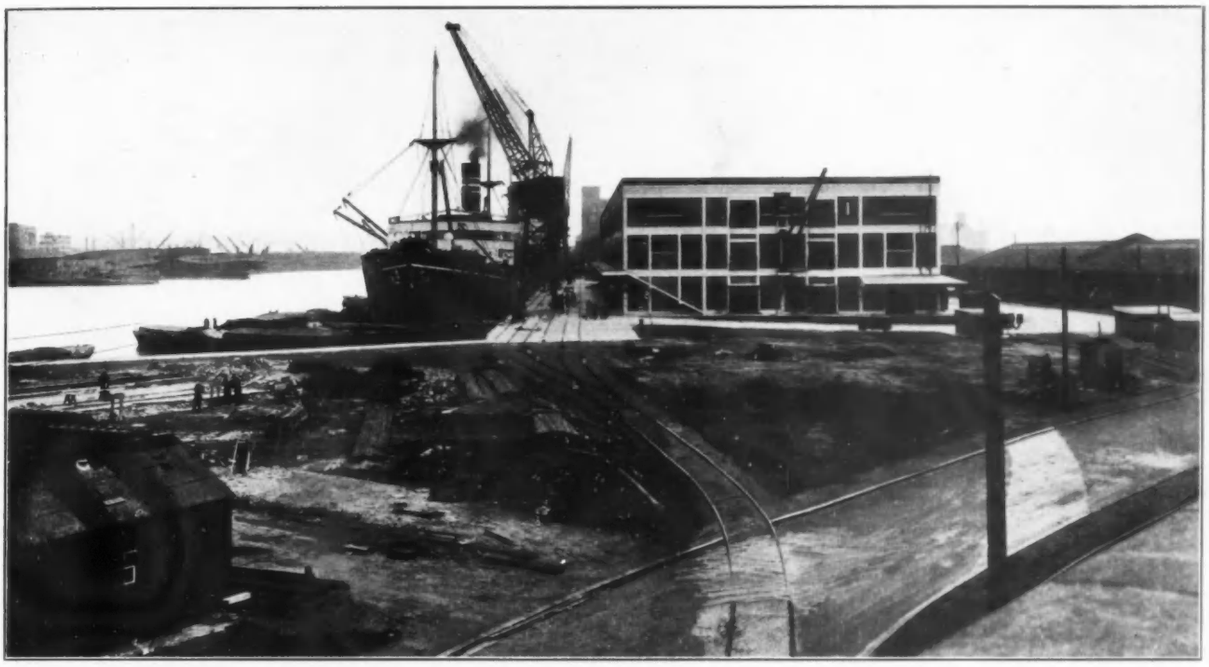
The details of construction are similar to those to be described later, the cylinders, beams and decking being suitably reinforced to take the additional weight imposed by the pressure from the filling of the reclamation and the surcharge from the loading of the ground floor of the shed.

The old brickwork in the jetties, and the foundations of the vaults therein, is broken up by explosives, removed by bucket dredger and deposited in the reclamation, whilst gravel filling, obtained by dredging below the normal bottom of the dock, is deposited in the reclamation by hopper barges to within 14-ft. of the water level; thereafter, the gravel filling will be pumped in as the several sections of the quay are completed.

The "Mudfield" Site

The excess depth of the dock will be partially refilled by soft material to be dredged away in front of the new quay at the "Mudfield" site. This site is on the south side of the dock, at the eastern end, and has long been derelict. The dredging will result in conforming the area to the line of the main south

Port of London Developments—continued



End View of Completed Quay and Three-storey Warehouse, and South Royal Victoria Dock.

quay of the dock, thus extending the effective quayage and considerably widening the approach from the Royal Victoria Dock to the Connaught Road Passage. There are already flour mills in the vicinity, and some five acres of the land has been let for the construction of another flour mill, and the opportunity has been taken to construct a quay wall to the remainder of the waterfront. Later, it is intended further to develop the area by building sheds here. When this scheme is completed with offices, equipment, etc., the cost will be over £400,000, in addition to the expenditure on the flour mill.

The quay wall, for a length of 1,800-ft., now completed, is of monolith construction, each block being 24-ft. 6-in. by 24-ft. 6-in. with four wells. This type of wall was adopted on account of the heavy nature of the ground and the exceptional surcharge from grain silos and other flour mill buildings.

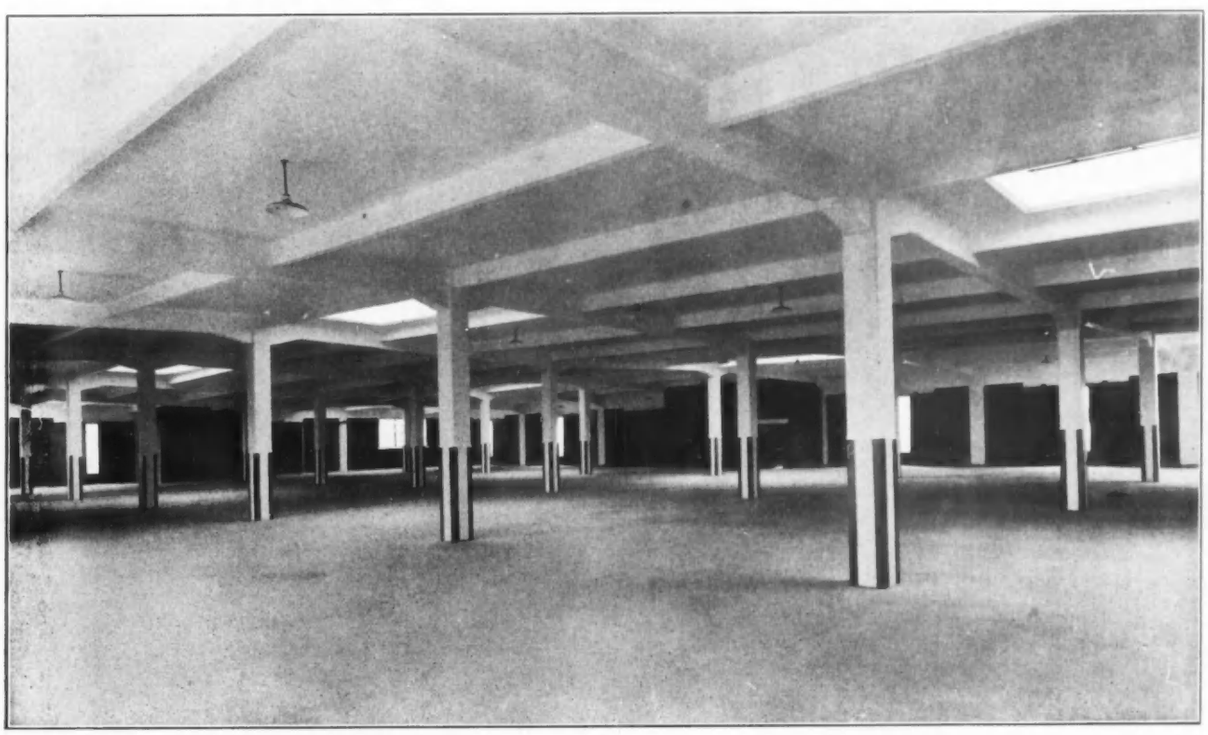
The monoliths were sunk in an excavated trench from the level of about 6-ft. 6-in. below the dock water line, and penetrated into the gravel strata below the future dredging level. The spaces, 4-ft. 6-in. wide between the monolith blocks, are sealed with a row of octagonal concrete piles.

The topping wall, built on the monoliths of masswork and reinforced concrete, contains a conveyor tunnel 16-ft. wide for the use of pneumatic discharging towers to be installed on the top of the wall.

The tunnel is waterproofed by a lining of bituminous felt, held in position by a skin of reinforced concrete.

Royal Albert Dock Improvement

A further development in this group of docks is taking place at No. 35 Shed, Royal Albert Dock. Here the existing shed, formerly a meat berth, has been dismantled and re-erected at the West India Docks for use for the storage of hardwoods to make place for an up-to-date terminal with mechanical appliances for the rapid discharge, handling and despatch of bananas. Contracts have been entered into for the work at a cost of £57,000, which it is anticipated will be completed early next year. The chief features of this scheme are the provision of an open steelwork shed in two spans, designed to carry one leg of each of four overhead travelling canvas-loop discharging



Top Floor of Three-storey Warehouse with Roof Lights with Non-actinic Glass.

Port of London Developments—continued

New Quay Walls, Mudfield Site. Sinking of Concrete Monoliths.

elevators, which feed on to four longitudinal conveyors placed on the loading banks, which are accessible to railway vans, or road vehicles. The railway vans will be marshalled past the conveyors by electric capstans with fluid transmission between the motor and capstan head. Each conveyor elevator is capable of handling 2,400 bunches of bananas per hour.

Electrification Scheme

The Royal Docks are also to share in an extensive electrification scheme. During the last century, when most of the docks were constructed, hydraulic power was considered the most suitable means for the operation of cranes, and consequently a large number of quays are equipped with hydraulic cranes. Now it is found that electrical appliances are more economical, generally, to cope with the varied types of loads encountered in normal ship working, and, moreover, are not affected by extremely low temperatures. Accordingly, the Authority have approved the electrification of various quays, and thirty 3-ton cranes have already been ordered in addition to thirty of the same type ordered a year or so previously. Together with trucks, runabout cranes, portable charging plant, piling cranes, stackers, etc., the total cost of this phase of the modernisation at the various docks will be £250,000.

(To be continued)

The Port of London Authority and the Registration of Wharves and Warehouses

At a meeting of traders convened by the London Chamber of Commerce on 11th October, Sir David Owen, General Manager of the Port of London Authority, outlined certain considerations which had led the Authority to take steps to promote a Bill in the coming session of Parliament, vesting in the Authority power to register public wharfingers and up-town warehouse-keepers, so that no persons or company shall be allowed to carry on such business without registration.

Sir David explained that spasmodic and unfair competition had been a matter of concern to the Authority for many years, and came from a number of wharfingers who, by not observing the standard rates of wages applicable to dock labour and by choosing certain commodities, were able to quote cheap rates for the warehousing of goods. The Port Authority as a public body must take any goods offered to them, whereas a private firm, acting as a wharfinger, could elect to deal with a particular commodity in minimum quantities and leave to the Port Authority the small parcels and any goods which might be difficult to handle.

Under the proposed Bill, a certificate of registration would only be given provided standard wages were paid to transport workers, registered port labour only employed when available, and the rates and charges were not less than those from time to time fixed by the Authority.

A full discussion of the proposals ensued, and finally the following resolution was carried with one dissentient:—

> "That this meeting of the Transportation Committee of the London Chamber of Commerce and of representative Trading Associations whose members are payers of rates on goods is of the opinion that the proposed legislation to give powers to the Port of London Authority to register public wharves and up-town warehouses with a view to the enforcement of uniform charges would not be in the best interests of the users of the port.
>
> "This meeting feels that the existing measure of private enterprise is a healthy feature tending to keep the Authority's charges at a reasonable level. The low charges made by the independent wharves also enable certain traffic to come into the port, which would leave the port altogether if the charges of these wharves were raised to the level of those made by the Authority.
>
> "This meeting therefore urges the Council of the London Chamber of Commerce to oppose the proposed legislation and pledges the support of the Associations here represented."

The Council of the London Chamber of Commerce subsequently adopted the recommendation, and these views were accordingly communicated to the Port of London Authority.

As a result of the foregoing meeting, the wharfingers of the Port decided to form an association, to be known as the Federation of London Public Wharfingers, and a general meeting of the newly-formed Federation was held on Monday, 25th October, at which Sir David Owen gave his official version of the Bill. Members of 54 Companies representing over 100 wharves on the river were present.

After hearing Sir David Owen, the meeting felt that they could not come to any decision until they had obtained and considered additional information on the subject from the Port of London Authority. The deputation which had previously waited upon Sir David was further convened as a sub-committee, and instructed to have further conversations with him on the whole question.

Notes of the Month

New Jetty for Port Kembla.

The New South Wales Government is considering seeking powers from Parliament to construct a third jetty at Port Kembla, the cost of which it is estimated will be about £180,000.

Improved Access to London Docks.

The new Glamis Road bridge over the Shadwell Entrance Lock to London Dock was opened at the end of last month. This marks the completion of another stage in the provision of improved road access to the Docks. The building of this bascule bridge and the work of widening Glamis Road was carried out by the London County Council, the Port of London Authority contributing towards the cost.

Increased Canal Traffic in Britain.

An increase of trade on the majority of British inland waterways and canals for the first six months of this year is shown by figures compiled by the Ministry of Transport. The total carried amounted to 7,280,573 tons, as compared with 7,092,723 tons in the corresponding period of 1936, an increase of 187,850 tons, or 2.65 per cent.

New Wharf at Falmouth.

The new King's Wharf at Falmouth Docks now nearing completion, will be capable of accommodating the largest vessels using the port. It is over 700 feet long, and has been constructed throughout of materials from the British Empire, the timber coming from Australia and Canada. Floodlighting arrangements have been provided, so that vessels can be handled at night.

Transporter Bridges for Bremen, Germany.

A pair of electrically-driven transporter bridges are being installed at the Port of Bremen. Each of these is capable of loading ore, coal or other bulk cargo at the rate of 350 to 500 tons an hour, using a grab crane which travels along the bridge. Provision is made for a belt conveyor to be mounted inside the lattice girders of the bridge structure. The whole of the machinery is electrically driven and controlled, and by a combination of electric driving with appropriate lay-out of the mechanical structure, a variety of movements of materials has been made possible, and, if required, the same equipment can be used to handle bale-goods.

Galway Harbour Improvement Scheme.

The Minister for Industry and Commerce (Irish Free State) has granted the sum of £200,000 to the Galway Harbour Commissioners for the carrying out of the first part of the scheme for the improvement of the harbour. The work will include the deepening of the approach channel and the removal of the rock barrier to a depth of 12-ft. below datum; the construction of a pier extending 350-ft. seaward from the S.E. pierhead Dun Angus; the completion of the Dun Angus Dock and the widening of the existing entrance to 65-ft.

Canalisation of the Weser.

Work on the scheme for the canalisation of the Weser, at an ultimate cost of 74,500,000 Rm., is now in hand. Of this sum approximately 12,000,000 Rm. will have been expended by the end of this year. The greater part of the work will be carried out between 1938 and 1940.

The scheme includes the construction of five dams, heightening of dykes, etc., dredging, heightening of banks, and the erection of plant for draining of land adjacent to the river by means of pipes. The works to be undertaken outside the river will consist of the construction of five lock canals, the erection of five shipping locks, the construction of 23 bridges over the lock canals, the construction of various culverts, and alteration of various dykes and raising of the level of tracts of land.

Four new bridges are to be constructed in 1937, and work on the construction of the actual locks will be commenced next year.

Bombay Port Trust.

At a meeting of the Trustees of the Port of Bombay, held on 21st September, 1937, the Board considered a reference from the Government of India relative to a scheme for the fumigation of vessels in the Port of Bombay by the hydrogen cyanide process, and decided to inform Government that while the Trustees are agreeable to the proposal, as an experimental measure subject to certain conditions, and to provide the necessary facilities, they considered that normally fumigation in the stream, as contemplated under the scheme, would not only cause great inconvenience to shipping but entail an undesirable risk, since vessels would be required to remain for some considerable time without any crew. The Board suggested that fumigation of vessels (except country craft) should normally be carried out in the docks, as is the practice at the Port of London and other large ports.

Wharf Extensions at Barrow-in-Furness.

The present accommodation at the fitting-out wharfs in Buccleugh Dock, Barrow-in-Furness, owned by Messrs. Vickers-Armstrongs, Ltd., is to be doubled by extending the wharf frontage to 1,800-ft.

Carradale Harbour.

The fishermen of Carradale, Kintyre, Scotland, have requested the Argyll County Council to consider the question of the immediate erection of a new pier and harbour at Carradale, as the existing pier has become unsafe and is in danger of collapsing. The petition is receiving the support of the Clyde Fishermen's Association.

Concrete Pier for Mackay Harbour, Queensland.

The scheme for Mackay Harbour, Queensland, has been varied from the original plans. Instead of a breast-wharf on the southern breakwater, it has been decided to build first one of the concrete piers in the harbour, leaving the wharf for a future date. The pier, when completed, will provide 1,532-ft. of berthage. The completion of the breakwaters is proceeding, and it is estimated that the total cost for the whole of the works will be nearly £1,600,000.

Short Season at Port Churchill.

It is reported that the Canadian Government vessel "N. B. McLean," which had been on patrol duty since early in July, left the Hudson Bay at the end of September. Owing to lack of grain, only two cargo vessels have cleared from Port Churchill this season, so that the Hudson Bay route has had one of its shortest seasons on record. Usually, the "N. B. McLean" does not leave the Strait until the middle of October. Although ice conditions were favourable, lack of shipping rendered further patrol work unnecessary.

Port Improvements at Auckland, N.Z.

An extensive programme of port development has been approved by the Harbour Board of Auckland (N.Z.). The scheme includes the construction of an export wharf at a cost of nearly £500,000, special accommodation for passenger and tourist vessels and provision for increased deep-water berthage by the construction of breastworks and quays and by reclamation. It is estimated the entire undertaking will cost £1,200,000, of which £1,000,000 will be raised by loan.

Canadian Shipping in 1936-1937.

According to the Shipping Report of the Dominion Department of National Revenue, Customs Division, for the Fiscal year ended March 31st, 1937, the tonnage of vessels entered inwards and outwards (sea-going and inland navigation, exclusive of coasting) during the past Fiscal year, totalled 94,586,746 tons, a record figure comparing with 93,735,227 tons in 1929. The previous year's total was 87,523,507 tons. At the same time, vessels entered and cleared coastwise reported a total of 91,421,172 tons for last year, as compared with 84,794,977 tons in 1935-1936. The previous highest total, recorded in 1929, was 97,053,685 tons.

Increased Trade at South Wales Ports.

The trade of the South Wales ports in the first eight months of this year recorded a gain over the same period of 1936 of more than 3,000,000 tons, while compared with 1935 it showed an increase of just over 1,000,000 tons.

From 1st January to 22nd August the total import and export trade of six Welsh ports was 17,249,345 tons, compared with 14,119,831 tons a year before.

Substantial gains were recorded in both the inward and outward traffics. Exports amounted to 14,330,117 tons, an improvement of 2,683,056 tons on a year ago. A satisfactory feature was provided by coal and coke shipments, which at 13,118,967 tons were 2,488,530 tons more than in 1936 and 535,131 tons more than in 1935.

Dry Dock at Gibraltar to be Enlarged.

Work on the enlarging of No. 1 Dock, the largest Admiralty graving dock at Gibraltar, at an estimated cost of £600,000, is to be put in hand immediately. The contract has been placed with Messrs. John Cochrane and Sons, Ltd., of Victoria Street, London.

When the dock was constructed in 1906, it was able to take the largest warship then existing, but the great increase in the tonnage of capital ships since that date has made it necessary to enlarge at least one of the graving docks at Gibraltar.

At present the dock is 851-ft. 9-in. long, 120-ft. wide and 38-ft. 7-in. deep, and the reconstruction will involve the pulling down and re-erection of the south-west wall, a slight increase in the depth of the entrance sill, and the lengthening of the dock. When completed, the new dock will be capable of accommodating any capital ship of the Royal Navy.

Transport in France

French Ports and Waterways

By F. J. WYMER, Associate Member (part of a Lecture delivered on October 19th, 1937, to the Institute of Transport)

The Commercial Life of France

For many centuries France has been a highly-developed country, but owing to the larger area compared with this country, she is far more self-contained, and her share of external world trade is much smaller than that of England and Wales.

Whereas Great Britain imports goods to the value of about £700,000,000 per annum, of which half is represented by foodstuffs, the imports of France amount only to about a third of this value, and foodstuffs represent only a third of the total imports. With regard to exports, those of Great Britain amount to a value of about £411,000,000, of which three-quarters are manufactured articles, while the exports of France amount to less than half this figure.

It follows that the French produce in France, for consumption in that country, large quantities of foodstuffs and raw materials, involving considerable internal transport by land and water. A brief indication of the self-sufficiency of France is given by a comparative table of productions or stocks of chief commodities, etc.:—

	France	Great Britain
Wheat	35,000,000 qrs.	8,000,000 qrs.
Barley	6,000,000 ,,	4,000,000 ,,
Oats	32,000,000 ,,	19,000,000 ,,
Potatoes ...	14,000,000 ,,	4,700,000 ,,
Beer	260,000,000 galls.	790,000,000 galls
Wine	1,672,000,000 ,,	—
Iron	5,750,000 tons	6,500,000 tons
Steel	6,000,000 ,,	10,000,000 ,,
Coal	45,000,000 ,,	223,000,000 ,,
Cars, etc. ...	166,000	417,000
Horse Stock ...	2,838,000	865,000
Cattle Stock ...	15,750,000	6,500,000
Sheep Stock ...	9,500,000	16,500,000
Pigs Stock ...	7,900,000	4,000,000

It will be seen that as compared with this country the production of iron, steel, minerals—and hence manufactured articles—is on a lower scale but, on the other hand, the produce of the soil is far greater. To a considerable extent this explains the even density of the population of France as a whole—the proportion of those engaged directly or indirectly in agriculture being high.

The Ports of France

No general survey of the transport system of France would be complete without a brief examination of the ports of that country and the system under which they are operated.

France is well situated in having coasts on the North Sea, the Channel, the Atlantic Ocean and the Mediterranean Sea, while she is further provided with excellent navigable waterways such as the Seine, the Loire, the Garonne and the Rhône.

Since the recovery of Alsace-Lorraine she also possesses direct access to that great European waterway, the Rhine.

Whilst not possessing a world trade comparable to that of Great Britain, or being world carriers of the goods of other countries, the French have always been an important maritime nation, and to-day their merchant fleet of three million tons is the seventh in the world, although small compared to the 20 million ton fleet of the British Empire.

Nevertheless, of a total external trade of about 74 million metric tons, about 45 million tons pass through the ports of France, the remainder by the navigable waterways of the eastern frontier and by land over the frontiers of Spain, Belgium, Germany, Switzerland and Italy.

Although far more self-sufficing than this country in the produce of the soil, France has to import large quantities of coal, hydrocarbons and minerals, while her agriculture renders necessary the importation of considerable quantities of fertilising material.

The status and organisation of the ports differ considerably from the practice of this country, and are of interest.

Basically, the ports of France are vested in the State—the responsible minister being the Minister of Public Works. To provide flexibility in operation and speed in decision (shown to be so necessary during the war) the actual control of the ports is decentralised, and in accordance with modern legislation the ports are governed in the following manner:—

(1) **Non-autonomous ports.**—The State (Department of Ponts et Chaussées) is responsible for the construction and maintenance of the port, but concedes the actual commercial working of the port to the local Chamber of Commerce.

(2) **Autonomous ports.**—The State remits its powers to an Administrative Council, as does the Chamber of Commerce. The State still exercises a degree of supervision through the Inspector General of Ponts et Chaussées, and the Minister of Public Works has power to veto the decisions of the Administrative Council.

Only the ports of Le Havre and Bordeaux have asked for, and been granted, autonomy.

The construction of port works is financed by (a) State grants, and (b) the proceeds of dues or charges levied on the traffic of the port. Maintenance of the port, which is a charge on the State, is recovered by appropriate dues.

Rail access to quays and docks is, normally, conceded to the main railway systems or the Chamber of Commerce.

The provision of lighthouses, lights, etc., rests with the State and light-dues are not charged.

In Great Britain, it may be remarked, only two ports—Holyhead and Ramsgate—are in the ownership of, and controlled by, the Ministry of Transport; the remainder are divided as under:—

(a) Owned and operated by statutory commissions or trusts ...	110
(b) Municipal authorities	70
(c) Railway companies	50
(d) Harbour companies or individuals	100

The principal harbours, with the exception of Manchester and Bristol, come under category (a) or (c).

The Navigable Waterways

The navigable waterways of France comprise portions of the Rivers Seine, Loire, Garonne, and Rhône and their tributaries, with a large system of canals connecting the natural waterways. The largest canal system is to be found in North Eastern France, and this connects the Seine, Havre, Rouen, and Paris, the coastal ports of Calais and Dunkerque, with the Belgian waterways, giving access to Antwerp, Liège, and Holland. The whole of this northern district is also connected to the industrial region of the Saar and Upper Rhine as far as Bâle.

Connection to the whole of this system is also made from the Loire and Rhône.

Status of the Canals.—From the earliest times, public rights have been maintained over the navigable portions of all natural waterways, and the riparian owners have, by law, to maintain towpaths along the waterways.

Artificial waterways have been constructed under systems analogous to that appertaining to ports: the public need for a canal having been proved, the canal has been provided by the State or by a body to which the State has granted a concession, such concession naturally imposing terms and conditions. The use of the canals, as of highways, is, in theory, available to all, but, in practice, and with the need, for example, of mechanical haulage, some organisation for the actual working of the canals is obviously necessary. As in the case of port operation, the principle of concessions is therefore resorted to—the concessionaires comprising bodies, such as Chambers of Commerce, vitally interested in the industry and commerce of the district.

The need for development of the working of the canal system, and in particular for the provision of a large and elaborate system of mechanised haulage, led in 1912 to the formation of a national office for navigation (the O.N.N.), which was given a considerable degree of autonomy. This body, in association with concessionaires, has formed the Compagnie Générale de Traction sur les Voies Navigables (C.G.T.V.N.) and La Traction de l'Est, which provides mechanical haulage over the northern system from Dunkerque to Bâle.

Where it is provided, mechanical haulage is compulsory, as otherwise an owner making use of horses would cause considerable delay in the working of the system. As on any large canal system, regulations are in force governing the type of barge as regards size, safety, and crew.

Co-ordination of Transport.—Following upon the financial crises of recent years, means have been taken to secure co-ordination of inland transport by rail and water. The chief measures ensure that no additional craft be constructed without the scrapping of equivalent obsolete tonnage; that the owners of private fleets, for the carriage of their own produce, should not compete with the public carrier—particularly by means of cheap "return loads"—and, finally, that the owners of craft should not be allowed to carry only the "cream" of the traffic.

A quinquennial census of craft using the waterways is taken, and at that of 1931 some 14,500 were recorded, of which over 12,000 were dead barges. It is of interest to note that 50 per cent. of the dead barges and 33 per cent. of those provided with motive power were owned by persons who possessed only one craft. The largest craft are those in use on the Rhine, where barges of up to 3,000 tons deadweight are in service, but two-thirds of all the craft are standard size canal barges of 270 tons deadweight.

It will be recalled that a comprehensive paper on "Mechanical traction on the French waterways" was given by M. Alvin, Directeur des Services de Paris de la Compagnie Générale de Traction sur les Voies Navigables, to the Institute on March 2nd, 1936, and was printed in the June 1936 issue of the Journal. This paper gave a great deal of information about the inland waterways.

The Handling and Ship-loading of Phosphates in Exposed Situations

(continued from page 348)

II—The Plant at Ocean Island

OCEAN ISLAND is situated about 160 miles east of Nauru and has probably been raised by similar volcanic action. The island is a very small place, only six miles in circumference, with its highest point reaching about 300-ft.

The bed-rock of the island is limestone, very hard, dense and jagged. Throughout the island it assumes a strange pinnacle formation, the phosphate being found in the deep hollows between these pinnacles.

The Ocean Island reef is a bad one both as regards building on it, and from the mariners' point of view. Its edge is serrated and broken by deep channels, and it is exposed to the full force of the Pacific. The reef shelves seaward at an angle of 45° for about 100-ft. and is then vertical.

As in the case at Nauru it is very risky for ships to lie close into the reef in anything but calm weather. Several vessels were wrecked upon it in the early days and upon one occasion a 7,000-ton vessel was lifted bodily on to the reef.

Rock Handling and Quarrying

The original method of loading the phosphate was to bring it to a short jetty in trucks where it was transferred to small boats. These were then rowed out to the waiting vessel and the phosphate hauled aboard in bags.

To improve on this a hopper was built on the jetty and truck loads tipped into it. From the hopper the rock passed down a chute into a lighter containing four baskets each holding 14 cwts.

The phosphate must be shipped dry and with the original system the rock had all to be sun-dried. The sudden heavy rains experienced at Ocean Island frequently caused delays.

In the years following the War when Ocean Island came under the Phosphate Commissioners' and the demand was steadily increasing an active policy of development was inaugurated, and it was under this scheme that the present plant was installed.

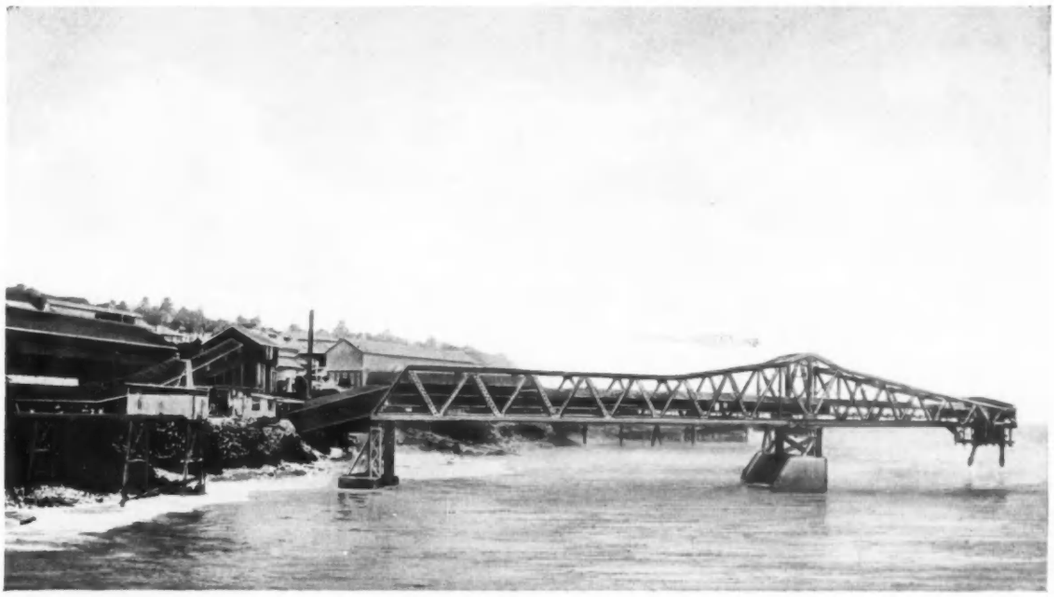
New Handling and Loading Plant

The success of the cantilever loading plant at Nauru naturally turned attention to the possibility of a similar installation at Ocean Island. A detailed survey was therefore made but it showed that the nature of the reef would render an undertaking of this kind too costly.

It proved possible, however, to erect a steel cantilever jetty and this was accordingly built in Home Bay in the south-west corner of the island. This jetty has proved to be a vast improvement on the ones previously in use. There is a greater projection beyond the surf, the cantilever arm being long enough to load boats outside the breakers. Since its installation it has been possible to speed up the shipping with surf-boats so that frequently vessels carrying 8,500 tons are loaded in three or four days.

The phosphate rock is transported from the deposits by aerial ropeway to a light railway, which delivers it to hoppers at various points. It is then crushed and dried and delivered to existing storage bunkers of 49,000 tons capacity on the foreshore. After crushing, the material is chiefly fine gravel with pieces ranging up to 2-in. ring gauge.

The material is delivered from the storage bunkers by an existing conveyor to the new conveyors delivering to the cantilever jetty along which the material is carried to the lighters.



The Cantilever Loading Jetty at Ocean Island.

The first of the new conveyors is 404-ft. long, 20-in. wide and runs at a speed of 350-ft. per minute. It is level and runs parallel to the shore. It is driven by a 15 h.p. motor and is fitted with a specially designed feed shoe. This feeds on to a second conveyor set at an angle of approximately 6° with the first and rising near the delivery end at an angle of 12° to a height of 35-ft. at which point it delivers into a 600-ton bin situated at the shore end of the loading jetty. This second conveyor is 222-ft. long and is also equipped with a feed shoe. Further it is provided, at the driven end, with a solenoid brake acting directly on the motor shaft. The brake operates immediately the current is interrupted, accidentally or otherwise, and prevents the inclined portion of the belt running backward and so spilling the material and possibly damaging the belt.

The 600-ton bin into which this conveyor feeds holds reserve material to enable the loading conveyor to be fed temporarily at a higher capacity to meet irregularities in the arrival of lighters at the delivery end.

The loading conveyor runs seaward from the bin and is carried on the cantilever steel jetty. It discharges the phosphate into baskets which are transported in small lighters towed by motor boats to steamers anchored in deep water off the reef. A light railway also runs along the jetty and is used for bringing phosphate from the older No. 1 Unit.

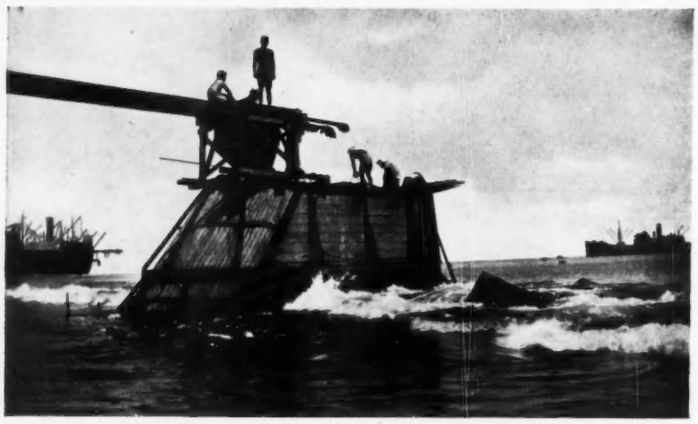
The loading conveyor runs at 350-ft. per minute and is driven by a 20 h.p. motor. It is fed from a jigging feeder at the shore end under the bin to ensure an even flow of material. The feeder is driven by a separate 5 h.p. motor. At the inner end of the conveyor there is also an auxiliary hopper from which the phosphate from the No. 1 Unit is discharged on to the belt.

All troughing and return idlers on the conveyors, as well as the driving and tension shafts, are fitted throughout with ball and roller bearings, automatically lubricated. The plant on shore is housed in timber gantries specially designed to withstand tropical conditions.

The Cantilever Jetty

The site selected for the new jetty was on a small peninsula about midway between the two old jetties and was chosen as being the most seaward point of the bay.

The Handling and Ship-loading of Phosphates in Exposed Situations—continued



One of the Concrete Outer Piers for the Jetty under construction, showing the difficult conditions under which the work was carried out.

It was decided that the foundations for the outer pier of the jetty should be placed as close to the reef edge as possible, and that the cantilever arm should be long enough to load boats outside the surf.

The foundations presented a very difficult problem owing to the formation of the reef, and the continuous surf which swept over it even at low tide.

Work was begun first on the inshore foundations owing to bad weather. Here the reef runs into a strand of pebbles, and a coffer dam of steel joists was built around the site of the excavations and the reef cleared of pebbles. The coral had to be blasted out to a depth of 3-ft. so that the pier could be well bonded into the reef. This proved to be a very slow and arduous task as only small shots of gelignite were permissible for fear of causing a fracture in the reef. Work was only possible at low water and after each tide the excavations had to be cleared of the pebbles washed in by the surf. A heavy timber form-work bolted on a steel framework was fastened to the reef over the completed excavations. Concrete was then poured in to a depth of 12-in. for the stanchion base. One of the stanchions, which consist of two 10-in. by 4-in. rolled steel channels braced together, was lifted in and set by four bolts previously sunk into the reef. The reinforcement was next placed in position and concrete was poured continually until the pier was completed. The same procedure was adopted for the other leg. The bracing and girder with expansion bearings forming the end trestle were then erected.

By the time the inshore foundations were completed the weather was good enough for work to be commenced on the outer pier, although even at low water there was considerable surf and it was often impossible for a man to stand unaided.

A further complication was the fact that two fissures in the reef, one on each side of the foundation site, had to be filled in to protect the foundations themselves from the action of the surf. They were filled by dropping in 4-ft. cubes of concrete. When the fissures were practically filled, the interstices between the cubes were packed solid with concrete in small linen bags which were bonded together with spikes. It was necessary to complete the blasting for the foundations before filling the fissures and the work was both dangerous and slow.

A heavy formwork for the concrete, built of 3-in. jarrah and weighing about 8 tons, was built on the shore and when ready it was brought rapidly into position. Concrete was then poured into the excavations through tremies to a depth of 6-in. and a steel grillage was set on this base.

The precise distance of the foundations from the inshore pier was determined by the length of the steelwork bridge and as this had not then been erected, it was not possible to concrete the stanchion in position. Furthermore it was not practicable to support the steelwork on the timber falsework owing to the danger of westerly gales. It was therefore necessary to leave the stanchion erected on the grillage and bolted to it, but not concreted. A concrete wall was built on the inside of the form to protect the base of the stanchion. The form was used for the other steel stanchion, and the same procedure adopted. Next the bottom booms of the steel bridge were erected on timber trestles, which were concreted to the reef for safety.

The main girder at the outer pier was then erected on the stanchions and the pin bearings were fixed. After the lower boom of the bridge had been placed in the pin bearings, the outer pier stanchions were concreted to a height of 15-ft.

The erection of the steelwork could then be proceeded with regardless of weather conditions and tides.

The total length of the jetty with the cantilever arm is approximately 300-ft. and the bridge span is 165-ft. 9-in. It is composed of two heavy steel girders braced diagonally top and bottom, with sway or portal bracing at each panel. The top and bottom booms are plate girders of " U " section, with web bracing of angles 10r the compression members and channels for the tension members. The section of the bottom boom ranges from 24-in. by 16-in. to 27-in. by 21-in. at the centre pier.

The jetty is decked with hardwood 3-in. thick. The conveyor roller brackets and the rail track are bolted through the decking to the steel members of the floor system.

At the inshore end of the jetty is situated a Blake-Denison automatic belt weigher, which continuously weighs and records the quantity of material delivered by the conveyor to the ship. At the outer end is an 18-ton hopper from which, by means of telescopic chutes, the material is delivered to the baskets in the lighters.

The conveyor is roofed with corrugated asbestos sheets and is enclosed on the western side with similar sheeting.

Electrical Equipment

The power supply is from the Commissioners' power station where current is generated by six Diesel engines. The supply is at 550-volts, 3-phase, 50-cycles. All the motors are of the continuous rated slip ring type. They are fitted throughout with totally-enclosed weather-proof starters. The shore conveyor starters are hand operated, whilst the jetty conveyor is fitted with an automatic starter.

On the shore line of conveyors motor control-gear is interconnected with a system of push-buttons in convenient positions for stopping the conveyors in case of emergency. The jetty conveyor is equipped with push-buttons at the inshore and outer ends for starting and stopping.

Additional Equipment

Since the completion of the handling and loading equipment at Ocean Island, additional plant has been installed to bring phosphate from the high ground near the quarries to the drying and crushing plant and the main storage bunkers on the foreshore.

The work includes steel receiving hoppers, wet phosphate storage bins of 2,100 tons capacity, the building housing the phosphate driers, four bins in the drier-building with a capacity of 640 tons, a series of conveyors for handling wet and dry phosphate between the receiving hoppers and the main storage on the foreshore, and further conveyors for distributing the phosphate to this store.

In addition to the plant for handling phosphate, mechanical equipment has been provided for handling and storing the coal needed for the drying furnaces. This includes a steel suspension coal-bunker of 1,000 tons capacity, with receiving elevator and conveyors above and below, and also a conveyor housed in a steel gantry for taking coal from the bunker to the drier-building where four hoppers are provided for feeding the furnaces.

Altogether, twenty-one new conveyors have been installed, eleven of which are carried in enclosed steel gantries. Seventeen are used for transporting phosphate and have a capacity of 125 tons per hour each. The remainder, which are of 25 tons capacity, are for handling coal.

A Simon " Reform " 30-cwt. automatic weigher has also been provided for weighing the dried phosphate before it is sent to the storage bin, together with four 2-cwt. weighers of the same type for recording the coal before delivery to the drying furnaces.

The Site for the Outer Pier Foundations. Note the deep fissures in the reef.

Canadian Harbours and Waterways

Excerpts from the Presidential Address of Mr. A. C. Gardner, F.R.S.E., M.Inst.C.E., to the Institution of Engineers and Shipbuilders in Scotland

The Presidential address of Mr. A. C. Gardner, Chief Engineer of the Clyde Navigation Trust, to the Institution of Engineers and Shipbuilders in Scotland, contained the following interesting notes on his recent Canadian tour on October 5th, 1937:—

As you commissioned me this summer to represent the Institution at the Jubilee Celebrations of the Engineering Institute of Canada, it may not be inappropriate if I take the opportunity of giving you an account of my stewardship and of describing some of the more outstanding engineering works I was privileged to see in the course of my visit.

The fiftieth anniversary of its foundation, which was attended by delegates from the leading engineering societies of Great Britain and the United States, as well as from India, Australia and New Zealand, marked an important stage in the life of the Canadian Institute, and I conveyed to the President on your behalf the congratulations of this Institution when I deposited with the Secretary the formal Address I was commissioned to deliver into their keeping. It marked also an equally important period in the history of Canada. The opening years of this half century saw the completion of the Canadian Pacific Railway and the linking of a continent from east to west. Its passage witnessed the harnessing of the power of Niagara and other rivers, and the bridging of the St. Lawrence with two great monuments of engineering skill; whilst its closing years saw the extensive development of the natural resources of the country, and the establishment of new industries on its soil. All these were milestones in the onward march of a country whose latest achievements in the engineering field are specially interesting and notably worthy of record. Let us begin with the river.

The place of the river in history and its influence on the development of a country possesses for the engineer an almost universal appeal, seeing that most of his greatest works have been carried out upon them, and the River St. Lawrence, the historic gateway of Canada, is no exception. Great among rivers, being more than 1,000 miles in length from Lake Ontario to the sea, the St. Lawrence is navigable for ocean-going vessels as far as Montreal, which marks the junction of its inland and ocean navigation.

Montreal Harbour

The harbour of Montreal is a Government undertaking, ownership being vested in the Crown and the management in the National Harbour Board. Its most conspicuous features are the huge grain elevators dominating the river front, and the new high-level bridge connecting the city with the town of Longueil on the southern shore. From Montreal seawards, the channel has been continuously deepened and widened in the last fifty years, and is now nowhere less than 450-ft. in width with a minimum depth of 30-ft., which is in process of being increased to 35-ft.

Montreal is a fresh water non-tidal harbour with a water front of 16 miles, with 10 miles of deep-water quays and 60 miles of harbour railways, 50 miles of which are electrified. The port is equipped with four grain elevators having a combined storage capacity of 15 million bushels, served by 28 deep-water berths, 23 of which can be occupied by ships loading simultaneously through a system of conveyors. During the year 1928, when the output reached a maximum, over 211 million bushels of grain was loaded for export at Montreal.

Although the principal grain-handling port in the American Continent, its activities are by no means confined to the grain trade, and it is interesting to record that last year over 10 million tons of general cargo was handled in addition to grain. As evidence of the general activity of the port for those interested in statistics, it may be stated that last year 6,543 vessels arrived in the harbour, representing a registered net tonnage of 9,570,825.

The inland navigation westward from Montreal is by way of the Lachine Canal and the upper St. Lawrence to Duluth, Fort William or Chicago on the Great Lakes, but the draught of vessels using the Lachine Canal is at present limited to 14-ft., owing to the depth of the lock sills.

The Welland Ship Canal

As might be expected in a vast country like Canada, so richly endowed with natural waterways and lakes, not the least important of the great engineering works that have characterised the period referred to, have centred around the extension of the chain of inland navigation from Montreal westward through the Great Lakes, Ontario, Erie and Huron, to Duluth on Lake Superior over 2,300 miles from the sea. The last of the links to be forged in this chain was the construction of the Welland Ship Canal connecting Lake Erie with Lake Ontario

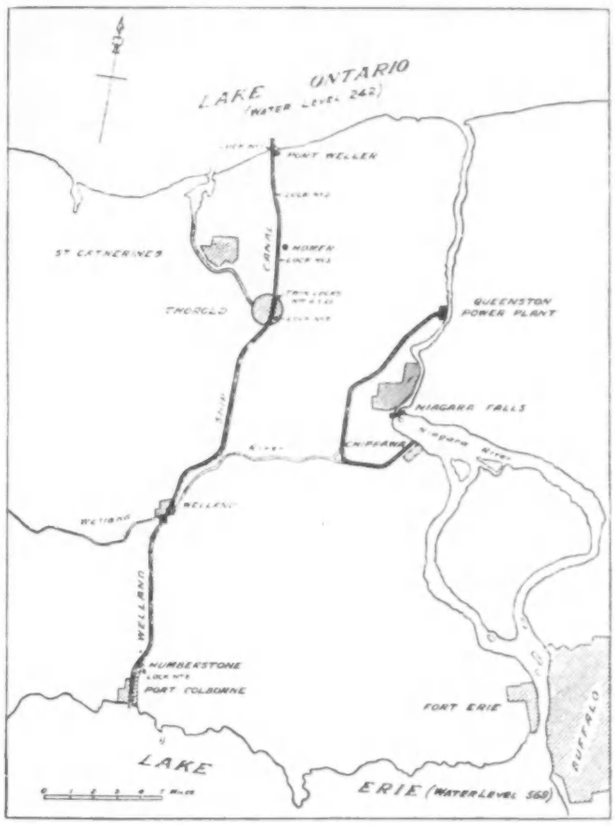
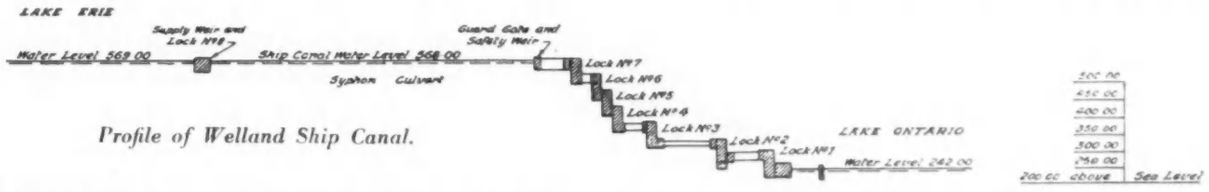


Fig. 1.

and crossing the Niagara peninsula to the west of Niagara Falls. This work has been very fully described in the technical press, but it is of such outstanding excellence that a few notes about it may not be out of place. Since 1829 there have been no less than four canals connecting the lakes in question, but the increase in volume of the grain traffic and in the size of vessels using the Great Lakes involved the deepening and straightening of the existing third canal, which virtually necessitated its entire reconstruction. The last canal, now known as the Welland Ship Canal, was started in 1913 and completed in 1931. It has a total length of 25 miles, and is considerably shorter than any of its predecessors. On the new canal there are 8 locks as against 40 on the first canal and 26 on the third. On the new canal seven of the locks have a length of 820-ft. with a width of 80-ft. and a depth of 30-ft. They are thus capable of dealing with vessels of very considerable size. The depth of the canal is 25-ft. with a bottom width of 200-ft.



Profile of Welland Ship Canal.

In consequence of Lake Erie being 569-ft. above sea level, whilst Lake Ontario is only 242-ft. above sea level, the canal has to be capable through its system of locks of lifting or lowering vessels through a height of 327-ft. This is accomplished in seven of the eight locks above referred to, and illustrated in Fig. 1. At Thorold, some seven miles from Lake Ontario, in addition to a large turning basin, there is a twin flight of three locks or six locks in all, having a total lift of 140-ft. These are similar to the Gatun locks on the Panama Canal which, though of greater dimensions, have only an aggregate lift of 85-ft. The first lock is at Port Weller at the entrance to Lake Ontario. Two intermediate locks of similar dimensions are located between that point and the twin system

Canadian Harbours and Waterways—continued

of locks above referred to, and immediately south of the twin flight another lock of similar dimensions gives the final lift up to the level of Lake Erie. All the locks are electrically operated and controlled. The construction of the new canal involved at one point the crossing of the River Welland, which was carried under the canal through concrete inverted siphon culverts consisting of six tubes, each 22-ft. in diameter. The control lock No. 8 on the Lake Erie side at Humberstone is the longest lock

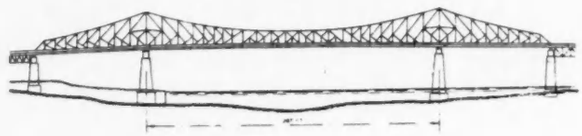


Fig. 2. Montreal Harbour Bridge.

in the world, its length being 1,380-ft. Mr. A. J. Grant, a former President of the Canadian Institute, was the designer and engineer of this great undertaking, which I now found myself admiring as an engineering work of the first magnitude, boldly conceived and admirably executed, and providing means whereby vessels of ocean-going dimensions may be raised, lowered or passed to and from the Great Lakes on either side.

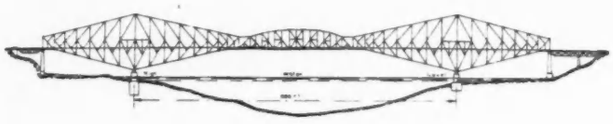
Toronto Harbour

In the course of my tour, I visited various engineering works on the Gatineau River at Ottawa, and at Hamilton and Toronto, at which latter place, through the courtesy of the Commissioners, I inspected the harbour. Toronto, formerly known as York, is situated on the northern shore of Lake Ontario, and as a modern port is practically a creation of the last fifty years. Fronted with a group of small islands, the harbour is virtually an enclosed water area many hundreds of acres in extent, approached by deep-water channels at the east and west. Since 1913 the Harbour Commissioners have reclaimed very large areas of foreshore totalling nearly three square miles, and this is being developed as industrial estates. The development at the east of the harbour is intersected and served by a ship canal, terminating in a basin 1,100-ft. square, and this, together with the canal, the width of which is 400-ft., provides deep-water berthage for ships over a total length of 17,000-ft. Here are located the huge coal storage yards, oil depots and factories for the industrial needs of a great community, both areas being served by railways and a very fine system of roads, which are being gradually occupied by manufacturing concerns. The completion of the Welland Ship Canal, which removed the barrier between Lake Erie and Lake Ontario, has enabled the largest vessels on the Great Lakes to use the Port of Toronto, the beneficent value of which great undertaking is reflected in the increased activity and development of the port.

The River St. Lawrence

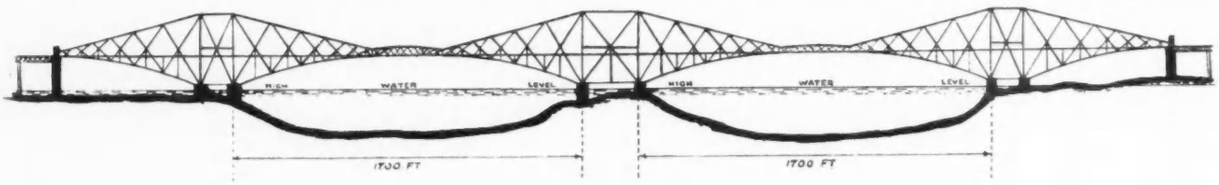
At Toronto, I embarked on one of the lake steamers for Prescott, where I changed on to a shallow-draught vessel, and so by way of the rapids in the Upper St. Lawrence to Lachine on the outskirts of Montreal. From Prescott to Montreal the upper reaches of the St. Lawrence consist of a series of lakes connected by a chain of rapids between groups of small islands. As the river narrows between these islands, over 1,000 in number, the speed of the water through the rapids is considerable, making navigation a difficult and somewhat exciting experience. At one point, for example, at Coteau where a navigation canal 15 miles in length has been built alongside the river, in order to avoid the rapids, a drop of 85-ft. in the water level takes place between one end and the other. The bottom of the river where these rapids appear is almost entirely of rock formation. A fault in the rock, giving rise to violent disturbances in the surface water, occasions the wave commotion which can be seen some considerable distance away. The removal of the rock and boulders in these rapids would, of course, render the river navigable, but their removal would be an almost insuperable undertaking, and would not seem to be within the realm of practical politics in a river which, under natural conditions, is closed by ice for a period of nearly five months every year.

Before we leave the St. Lawrence, I should like to refer to the two great bridges that have been erected across the river in recent years. The first of these is the famous cantilever bridge at Quebec, which was completed in 1917. It has a central span of 1,800-ft., and a suspended span between the cantilevers of 640-ft., and is the largest single-span cantilever bridge in the world, whilst the suspended span continues to hold the record in Canada as the longest simple truss. In general appearance, the structure is not unlike our own Forth Bridge, but distinctive differences may be recognised in the system of K bracing



Quebec Bridge.

adopted in the diagonals of the main truss at Quebec, and in the fact that whilst in the Forth Bridge the towers as well as the main cantilevers are battered, in the Quebec Bridge the trusses are parallel throughout. The second and more recent is the Jacques Cartier Bridge at Montreal, completed in 1929, and as figure 2 shows, is also of cantilever construction, with a central span of 1,097 feet. The K system of bracing was again adopted in this bridge, and high Silican steel employed in all the main members. Both are high-level bridges, with a clearance of 160 feet or so above high water, and are imposing structures, enhancing rather than detracting from the mightiness of the river which they cross. Both these bridges, and in a different category the graceful suspension bridge across the northern arm of the river to the Island of Orleans with a span



The Forth Bridge.

of 1,059-ft., are fine examples of the bridge builder's art, whilst those ardent advocates of welding as the natural successor to riveted structures, may find in Canada across the St. Anne River in Quebec Province at La Perade, a continuous plate girder bridge of six spans each of 107-ft. and all welded throughout. Time will not allow me to describe these in detail.

The Port of Chittagong

Excerpts from Administration Report for 1936-37

The result of the year's working as compared with that of the previous year is as follows:—

	1935-36.	1936-37.	Difference.
	Rs.	Rs.	Rs.
Income, ordinary	6,46,978	6,81,605	+34,627
Expenditure, ordinary ...	4,23,110	3,83,880	—39,230
Net Revenue	2,23,868	2,97,725	+73,857

Income.—This shows an increase of Rs. 34,627 over that of the previous year, chiefly due to the larger importations of rice and paddy and larger exportation of jute.

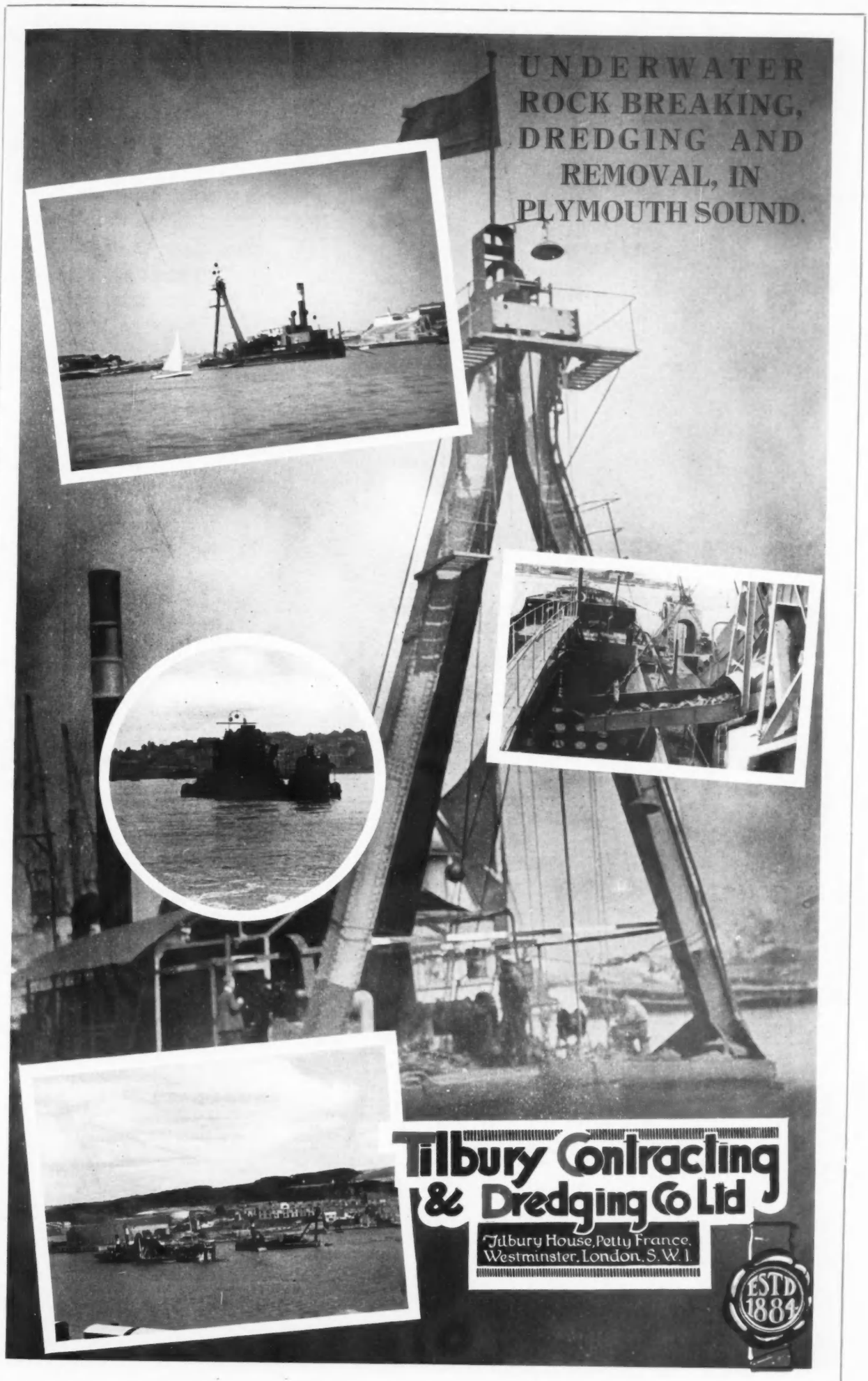
Expenditure.—Ordinary expenditure amounted to Rs.3,83,880 as compared with Rs.4,23,110 for the previous year, representing a decrease of Rs.39,230.

Shipping.—During the year, 820 vessels of a registered tonnage of 568,836 entered the port, as compared with 819 of a registered net tonnage of 540,970 in the previous year.

The results of the year's working are considerably more encouraging, revenue having increased and expenditure decreased. Revenue is, however, still much below the average of the last 10 years, and the improvement is not such as would yet warrant the removal of the 12½ per cent. surcharge on river and port dues.

The steady improvement in the condition of the river brought about by the river training works that have been carried out in the last 8 years, and the consequent reduction in the dredging, give every reason to hope that if the further schemes for river improvement, which have been approved by the Port Commissioners and are now under consideration by the Government of India, can be carried out, dredging may be dispensed with altogether.

The Report was signed by G. E. Cuffe, Esq., Chairman, Port Commissioners.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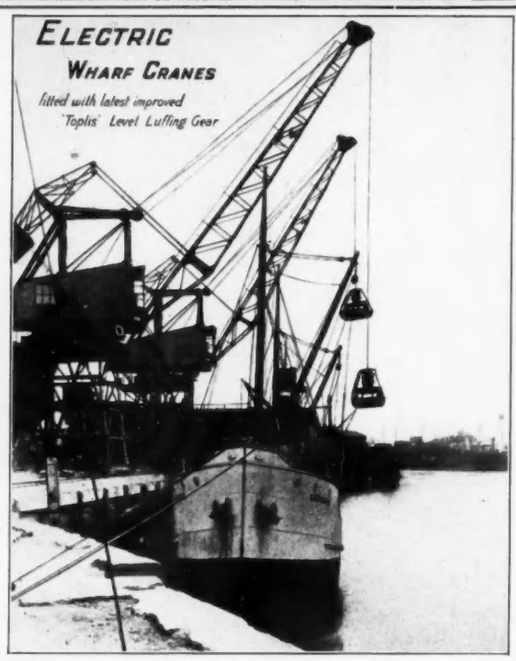

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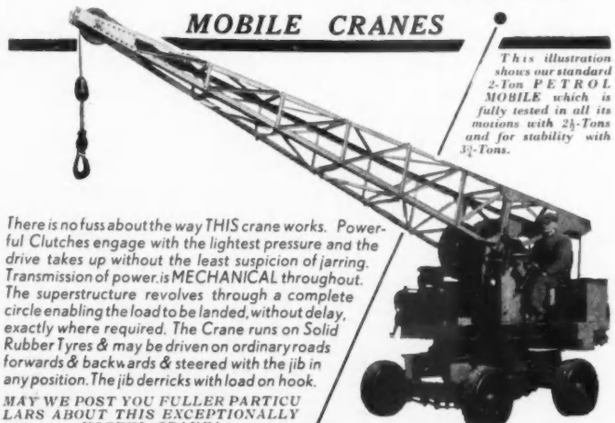

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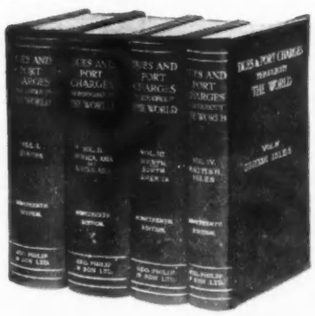

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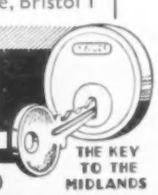

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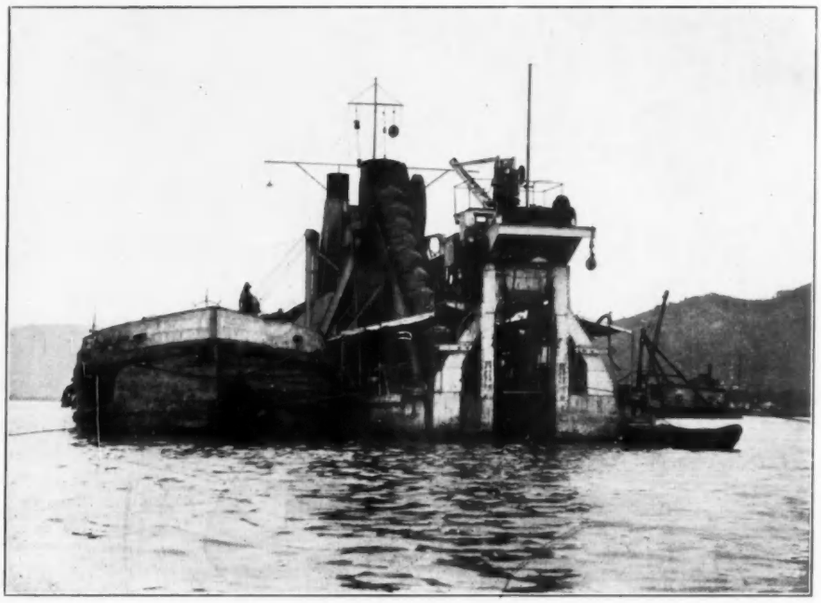

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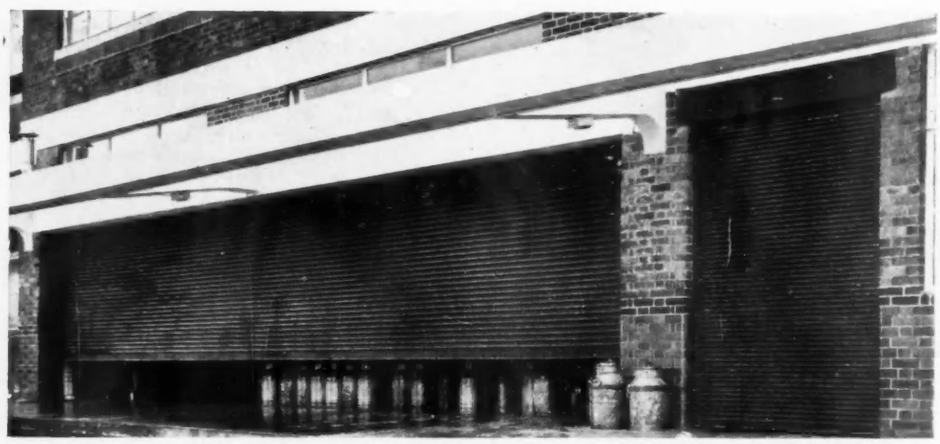

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The Port of Bordeaux and the Estuary of the Gironde

By M. F. LÉVÊQUE, Chief Engineer and Director of the Autonomous Port of Bordeaux

(Translated from the French)

Introduction

THE engineers of the autonomous Port of Bordeaux were in 1926 at grips with a problem particularly formidable for the future of the port, namely, the maintenance of an external channel of approach to the interior channels of the Gironde leading to Bordeaux.

The problem, which nature imposed upon them so abruptly, has been solved under very favourable conditions, but only as the result of numerous investigations which have been made, alike on the water and on the land. It is solely the intimate association of water and earth which has permitted the formation, almost in the open sea, of a new channel, which is actually the best organised of all the world channels providing access to great estuary ports. These studies have been compiled and assembled in the single work of reference which is produced below.

The Necessity for a New Pass

Until 1926, the Port of Bordeaux had, as an entrance Pass, the natural channel called the Passe des Charentais, or North Pass, used for more than a century, a cutting through the submarine shallows, forming the exterior bar, which is designated in a general manner the Great Bank.

This pass had unfortunately a regrettable propensity to drift more and more in a north-south direction, taking at the same time a sinuous course and approaching dangerously to the side of the Coubre. At the same time, the depth on the Pass diminished to such an extent that in two years the depth at low water, that is to say, below the zero of marine charts, had retrograded from 9 metres to nearly 6½ metres only. It was the entrance to the Port of Bordeaux which was being closed so abruptly.

Applying thereto the English formula " Wait and see," there was temporarily opened for use a secondary pass called Passe du Matelier lying south-west—north-east, which possessed depths ranging between 7½ and 8 metres below low water, but presenting unsatisfactory navigational conditions in bad weather. Steps were then taken to study with a certain anxiety the problem of opening out a new pass which had become absolutely indispensable.

Investigations of the Autonomous Port

When the engineers of the Autonomous Port, among whom in the first rank must be placed MM. Crescent and Durepaire, examined closely the data of which they could make use, they quickly recognised that no systematically complete investigation had been made hitherto capable of affording guidance. We knew from the actual experience of the rapid closing of the North Pass, that a geographical environment, in the sense of the scholar M. Lutaud, can rapidly become an adversary, and that to be converted into a friend, as is necessary in the case of the exterior bar of the Gironde, it was essential to come to terms with it. It was then indispensable in this transaction to know the other side in order to derive the greatest advantage.

We had already excellent material at the outset, accumulated by the expert hydrographical engineers of the French Marine. We had, in particular, for the exterior passes, surveys made in 1825 by Beauteamps-Beaupré; in 1853 by De La Roche-Poncié; in 1874 by Manen; in 1892 by Héraud; in 1912 by Fichot; in 1924 by Volmat; these two last hydrographical engineers having closely studied the tides and the depths of the estuary. Our predecessors in the Marine Service of the Gironde had also investigated certain interesting points.

Since 1926 I have prescribed, in addition, annual surveys by the Hydrographical Service of the Autonomous Port. Furthermore, I have asked my colleagues to arrange and complete certain of the results obtained, proceeding both on investigations followed from the hydrography of the river, properly so-called, and on oceanographical studies, since we were navigating sometimes in what it is agreed to call a river above Pointe-de-Grave, sometimes in what is officially the sea, downstream.

We have proceeded then beyond the hydrographical investigation of the liquid and solid discharges, or the salinity, or the acidity, or the rainfall to the study of the essential elements of oceanography, that is to say, the form of our marine Gironde Basin; the composition of its waters; the temperature; the movement resulting from the action of the waves; the tides; the currents; the waves; the biographical conditions of the environment; the composition and distribution of sediments of the rock in situ which carpet the bottom, whether partly or wholly marine.

Many of these studies are still under way and we are amplifying them constantly; but the first results have at least permitted us to find a rapid and sufficient solution for the most urgent problem, that of opening our new pass.

Geographical Studies

We have begun with geographical studies on the land and under the sea. I am indeed persuaded that the actual state of affairs is only intelligible if one can retrace the steps of its history and of its earlier evolution. I find it very natural to admit in physical geography a sequence of events without interruptions, without successive cataclysms, thus following the principle of actualism established by Hutton and Lyell. It is necessary to take advantage of that which we discover about a past which cannot be reproduced entirely under our eyes.

I will relate simply that the principal features of the structure are the following:—

The basin of sedimentation, called the Aquitaine Basin, of 75,000 square kilometres in area (equal to the flood basin of the Mississippi), is drained by the Garonne and by the Dordogne, then by the river formed by their junction called the Gironde. This basin is a physical unit, perfectly individualised. It collects the waters of two great centres of hydraulic diffusion, the Pyrenees and the Central Plateau. It leans to the North on the hercynian massives of La Vendée and of the Central Plateau; to the South on the Pyrenees Chain. Its definite emergence only dates, in fact, from the Miocene.

All the Point of the Médoc, the rocks of Cordouan, certain peaks visible at Saint-Nicolas in front of Cordouan, the under river shallows situated on the left bank from about 20 kilometres above Pointe-de-Grave towards Saint-Christoly, are composed of

Port of Bordeaux and Estuary of the Gironde—continued

Lutetian chalks belonging to the middle Eocene. These chalks have been attacked by marine erosion and there only remains at the present time, easily accessible on the surface, some fragmentary evidence, sole remains of a continuous sheet now eaten away, at least on the surface, by marine erosion.

On this general substratum supporting all the Point of Médoc and what one finds in the sea in front of it, the sea has entered, largely, at least, into the estuary at the Flandrian of M. Dubois, at a quaternary epoch which must be contemporary with the end of the final glaciation, the Wurmian glaciation. The Pointe-de-Grave and sundry other tertiary projections like the actual projection of Jau., 12 metres high, were then islands. A marine littoral chain, of which proofs are to be found in the Gironde, as elsewhere in the old Gulf of Poitou, now become the Poitou Marsh, is very visible. Around the islands after the period of excavation of the Flandrian, has taken place a filling, also Flandrian, which continues at the present time, in uniting by veritable polders, certain former islands, and in laying down in the river important shoals in course of evolution, leaving elsewhere, through serious gaps, to appear the former Flandrian terraces.

The filling brought about, at the time of the Wurmian glacial catastrophe, a powerful erosion of the Central Plateau and of the Pyrenees, which brought down materials of considerable size in the Dordogne and the Gironde, the union of which constitutes the Gironde. At Saint-Christoly, as at Pointe-de-Grave are to be found such materials, constituted, above all, by blocks of quartz, by metamorphic rocks, of which one can determine the probable origin; there are, in particular, certain boulders of Mount Dore and of Cantal reaching 40 to 60 centimetres in length. Coarse alluvions are also to be found consisting of stones of 8 to 15 centimetres, of sand and blue clay; these prehistoric alluvions are already partly consolidated in an irregular manner. More recent deposits (brown muds) are found in the channel and they date from a period which can reach back from the present time for several centuries only. They are, according to M. Glangeaud, estuary deposit types formed of very fine elements, some of detrital origin (small grains of quartz and little micaceous particles), some of colloidal origin (clays), some of chemical origin (precipitations of Limonite, ozide of iron). There is naturally less of the colloidal element in the older clays; the presence or absence of such material as glauconite is also a clear indication of antiquity.

Above all, at the exterior of the estuary, there are met with in addition, on the lutetian and general foundation, shoals of sand, generally submarine and more or less extensive, but migratory and formed of dune sand and marine shells. They originate, like the terrestrial dunes which they extend under the water, from the selection made by the sea, then by the wind from the immense mantle that constitutes the formation of sand on the Landes which covers a good portion of the basin of the Garonne and involves itself elsewhere rather frequently in the alluvions of the Garonne itself.

The Littoral Dunes of the Atlantic

The sands of the Landes are among the products of the destruction of crystalline rocks which have been drawn into the lower portions of the Aquitaine Basin and have undergone redistribution in consequence. They originated in the Pyrenees or in the Central Plateau. The share of the Pyrenees is more in evidence as one approaches more closely to that powerful chain of mountains, but there are, towards the estuary of the Gironde, indisputable elements from Auvergne. The name of " Sands of the Landes " is given more particularly to the part of the immense formation which is nearest to the Atlantic seaboard.

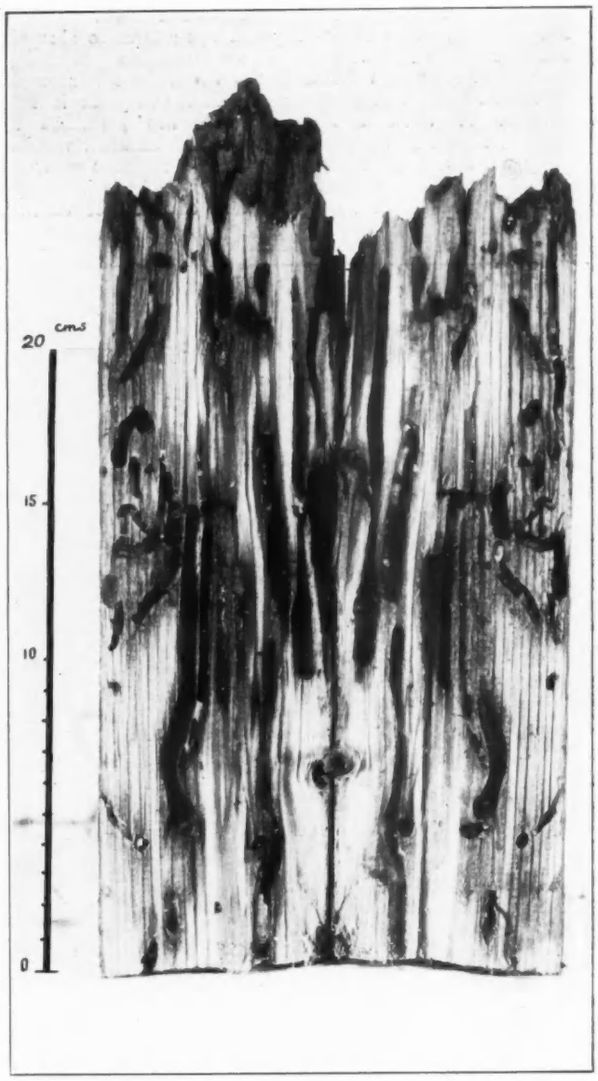
Over the tertiary substratum of the western part of the Aquitaine Basin is encountered, above the products of coarse elements of diluvium, a very continuous bed of sandy, gravelly or argilaceous material.

Has this bed predominantly the character of a construction of the old Adour or of a construction of the Garonne? It is sufficient to know that it is chiefly the result of the combined efforts of these two leading Pyreneean affluents, taking their material from a geological region relatively young and contorted. The sands of the Landes attain rather considerable thicknesses, of the order of 100 metres in the neighbourhood of the lighthouses of Cape Ferret (North entrance of the basin of Arcachon) and of Grave.

These deposits have extended themselves as far as the Lutetian and post-Lutetian sea. They have been actuated directly by the waves and winds of the offing. The sea has worked on them as it does on all banks of heterogeneous elements; it has carried away, in order to place it in deposit, in suspension, or in solution, sandy and clayey elements more or less laden with colloidal salts. It has left on the site the individual elements too heavy to be borne horizontally over the bottom by traction.

The relatively light elements have formed the shifting underwater banks, the ridges, veritable undersea sandhills, which are scattered over the Continental Plateaux of the Gulf of Gascony and of which the constituent materials are thrown back to a slight extent on the coast of the Landes during heavy weather.

It is necessary to remark in this connection that the ridges have generally appreciable dimensions of the order of several metres (8 to 13 metres in height in the banks in front of Dunkirk and 200 metres in length); but they have precisely the profile of sandhills in movement with pointed crests and constitute very dangerous moving shallows. Smaller ones, less accentuated, are to be found in certain rivers, with grains of sand of 4 millimetres, such as the Estuaries of the Rhine (Merwede and Lek), where, in mean depths of 4 to 6 metres, they are discoverable by sounding, with unsymmetrical wave lengths of 1 to 1½ metres, say 20% of the free depth (see Revue Hydrographique, May, 1935, M. Joh. van Veen).



Teredo at work in Maritime Pine State of the wood after eight months immersion.

The same phenomenon is found on the strands of the Girondine and Landesian beaches, but on a smaller scale, in the shape of ripple marks, little ridges, more or less parallel, which are formed towards the mid-tide when the sea is withdrawn from the shore.

The outline of the ridges and the photograph of the ripple marks, more or less accentuated, more or less regular, determined on Pointe-de-Grave, explain clearly this distinction of terms, if not the method of formation.

This coast is subjected to tidal variation levels which can reach 5 to 5½ metres at spring tides; the strand, on which the sea is arrested at each instant, has a feeble slope, very feeble sometimes (1 in height to 40 to 50 of base). This strand is thus very extensive, it often comprises zones of several hundreds of metres in width measured along the line of the greatest slope of the beach.

It is on this immense Atlantic strand, extending over more than 200 kilometres, the length of a meridian (nearly 2 degrees of longitude) that are deposited or retaken by the waves in good or bad weather the sands and the minute elements put in suspen-

Port of Bordeaux and Estuary of the Gironde—continued

sion by the sea. When the wind comes on shore, which is actually the most frequent occurrence along the Gulf of Gascony, at falling tide, the more or less clayey or colloidal sand dries rapidly, especially in fine weather, and with the atmosphere slightly hygrometric. The finest elements are thus drawn towards the land by the wind, which makes them rapidly pass beyond the normal extent of high tides.

According to Udden, indeed, the wind can, by traction along the ground and by suspension in the air, produce important movements in elements not exceeding generally 2 millimetres; particles of 4 to 8 millimetres in diameter can traverse several metres in average winds; sand from 1 to 4 millimetres can traverse 1 to 2 kilometres; a very fine sand from one-eighth to one-sixteenth of a millimetre in diameter can be drawn over several kilometres; as for the dried mud or quartz, from one sixteenth to one-thirty-second of a millimetre in size of particles, these can traverse hundreds of kilometres.

The dunes, which have been formed along the River Jaxertes on the borders of the Caspian Sea, are capable of migrations which have reached 20 metres per day. The dunes of the Biscayan Coast advance from 3 to 30 metres annually. The dunes of Gascony, too, when they were unchecked, advanced seriously

Detail of the Rocks at St. Nicholas.

in places; witness the basilica of Soulac-sur-Mer buried in sand up to the roof in the 15th Century and disinterred in 1850; the littoral dunes north of Soulac, which cover a site of a character manifestly fluvial and on which are to be found, after great onslaughts by the sea, exactly the same rock formations and undulated clay, which are met with in the interior towards Soulac. Witness also the great dune of Pilat (112 metres high in 1932) at the south entrance of the Basin of Arcachon, which according to precise measurement, has along 4 kilometres of coast-line, buried quite recently on its interior face, a depth of more than 118 metres of forest in 13 years. Its height has varied at the same time from 60 metres in 1844 to 112 metres in 1932.

It is necessary also to note that deposits of material in suspension can singularly complete the current deposits, since the particles in suspension in the air as in the water attain a fineness almost infinite. It is to be noted equally that, in consequence of the absence of a covering bed, of a film of water, the elements of erosion suspended in the air, can attain dimensions lighter than those in suspension in the water.

A part of the marine deposits is thus by the action of the wind, withdrawn in a more or less definite manner from the action of the sea. This phenomenon is more accentuated when the tides are falling, that is to say, when they are decreasing from spring tides to neap tides, by a progressive diminution of the tidal coefficients.

There is produced definitely along the coast, above the mean level of high water, an accumulation of siliceous sand and light material containing from 5 to 10% of lime in the form of broken shells, which constitute either the supply or the erosion of a dune.

This phenomenon presents peaks and hollows, according as the wind conveys to the land (the more often), or to the open sea, or again along the coast, North-South. The sanding up is accelerated generally in fine weather and decreases in bad weather. It is fostered during the periods of vegetation by the growth of young plants or gourbet (arundo arenaria, " oyat," or " psamma des sables ") of panicauts, of pebbles and diverse components, of cruciforms and other decayed vegetation, and defending itself more or less effectually against the sand and the sea air by the accretion or thickening of the organisms.

It is easy to follow at the present time the process of the basic formation of the dunes by examining the progressive sanding up of the North Coast and above all at Soulac-sur-Mer, following the construction of works suitably disposed with a view to protecting the coast from the sea by utilising its own power to augment rapidly, automatically and freely the foot of a pre-existing dune. These dunes, ancient or modern, are formed in lines, more or less regularly and stable, sensibly perpendicular to the prevailing wind (which is here largely identical with the most powerful wind).

The new dunes, formed less than 50 years ago at the southern point of Cape Ferret, which borders to the north the entrance passes of the basin of Arcachon, give complete support to this view of the idea of the local formation of contemporary dunes. but the extreme dunes off Cape Ferret are still wild, not planted, undefended and well represent what might be, even under other meteorological conditions, the most ancient littoral dunes which border the Gulf of Gascony.

The sea has gained on the land along this gulf since the sands of the Landes have spread out. For this it is not necessary to suppose a cataclysm; the eustatic movements of equilibrium of the terrestrial crusts are sufficient, especially those that are associated with the complete quaternary sedimentary cycle of the Flandrian. There will be seen later a serious local accentuation of movement towards the Point-de-Grave.

One discovers indeed to the seaward of the actual coast of the Landes and of the Gironde, important lines of large silesian pebbles in depths of the order of 50 to 100 metres. These pebbles rest now on a beach almost horizontal, and it is probable that they were the play of currents which had extracted them from the modern coast, conducting them more or less rapidly towards the open.

A reference can be made in this respect to the experiments of Suchier at Brisbac on the Rhine, who shows by classic experiments, that in order to be drawn by a current of water, pebbles of 250 grammes require a current of at least 1½ metres per second at the time of a general agitation of the place. This corresponds to a current of 3 knots which has not been observed hitherto in the plans of the Continental Shelf, where the marine lithographical charts indicate continuous lines of pebbles.

These pebbles are therefore the evidence of a former shore more or less steep on which the sea has acted, as usual, in carrying away the light material and in concentrating, little by little, the larger elements, while lowering progressively the bottom by excavation. Such a concentration of large elements on the surface has been located by the engineers of the Autonomous Port of Bordeaux, not only on the quaternary terraces of the Gironde near St. Christoly or of Lagrange, for instance, but again on the flinty bottoms, more or less aureolated situated along the exterior entrance channel to the Port of Havre, where are to be found in places on the surface a mantle of large silicious elements up to 50 centimetres in maximum thickness, overlying beds of sand and gravel, with various elements of dimensions usually much less.

The sea, above all, in depths relatively shallow, such as 10 to 15 metres below low water, has a marked predilection for the lighter elements that she carries, abrades, deposits and refashions in a hundred ways, but she disdains the large elements which are much too stubborn for marine movements.

These discarded elements take their revenge on the sea in forming little by little against her a continuous mound of material of comformable thickness, and which as such, according to Gilbert, is not only much more difficult to set in movement, but prevents ulterior attacks of underlying shoals.

We are then on the coast of the Gulf of Gascony, in presence of a very simple process. The sands of the Landes, are, above all, to the right of the estuary, notably more advanced than they now are towards the west; they have been in consequence of variations of sea level more or less slow, attacked, lifted and drawn; strips of pebbles have remained in place, evidence of an ancient line of bank particularly rich in pebbles, or fixed in position. The remainder of the sandy argilaceous lime

Port of Bordeaux and Estuary of the Gironde—continued

magma has given the body of sandbanks which drift along our county coasts, especially on the rocky plateau of Cordouan, the light material of the dunes ever moving towards the interior of the land; then, finally, there are these enormous masses of material in suspension, or in solution, in the sea, which are the last remains of the eternal marriage of the land and the sea on our coasts.

Such are the elements of the most evident marine depths with which we have to do in front of our Girondean Estuary on the solid lutetian bottom.

This solid bottom is, moreover, itself susceptible of important transformations, at least on the surface, for it is suffering direct erosion.

Marine Erosion in the Gironde

The lutetian erosion has been, indeed, most important. We have been able to capture alive one of the actual agents in this erosion. The whole coast is actually a prey to lithophagous molluscs called pholades, the rapidity of attack of which on the chalk exceeds the most pessimistic forecasts. According to M. Dangeard, these molluscs, accompanied elsewhere in the Gironde by other boring agents, such as polydor worms, seaweed and sponges, traverse in every direction by their tunnellings the former fractures of the chalk and finish up by isolating fragments, afterwards carried away by the waves. Pholades are encountered in the open and in great depths of the order of 75 to 100 metres at least.

These organisms attack not only stone but also deep-seated timber. A piece of oak, half fossilised, found in the roadstead of Pointe-de-Grave, contained pholades belonging to a variety of considerable size.

In the wood, moreover, the pholades are not the most active elements, for at the Pointe-de-Grave, for instance, pieces of maritime pine, having served for provisional framing, have, after only 8 months, been rendered completely useless by teredo. In other cases there are visible in the chalk pholades, relatively young, embedded either in the calcareous blocks of Blaye, employed as sea protection works and put in place by myself in 1908, or in the lutetian blocks in situ. When fissures exist in the chalk the penetration of pholades is much more considerable and complete blocks of 10 to 16 centimetres thick have been easily broken off by the sea after several years of work by mollusc borers.

I have been able to see myself on the lutetian rocks of Saint-Nicolas that, in two score years, shoals on which I had installed specimen blocks of concrete on a rock sensibly horizontal, had around these blocks lost between 5 to 8 centimetres of thickness of their superficial crust, the concrete remaining throughout free from attack. This is not surprising since Joyeux-Laffuie has calculated that the rocks of Calvados lost 10,000 cubic metres with each generation of polydor worms.

The sea is particularly disturbed along all this coast. It lies indeed on a very gentle Continental platform, which brings about a breaking and shortening of the waves, and these have generally, and apart from exceptional storms, a length of 25 to 70 metres, and a period of 4 to 7 seconds; the attacks of storms are violent and amplify local attacks such as those of the pholades and of the worms.

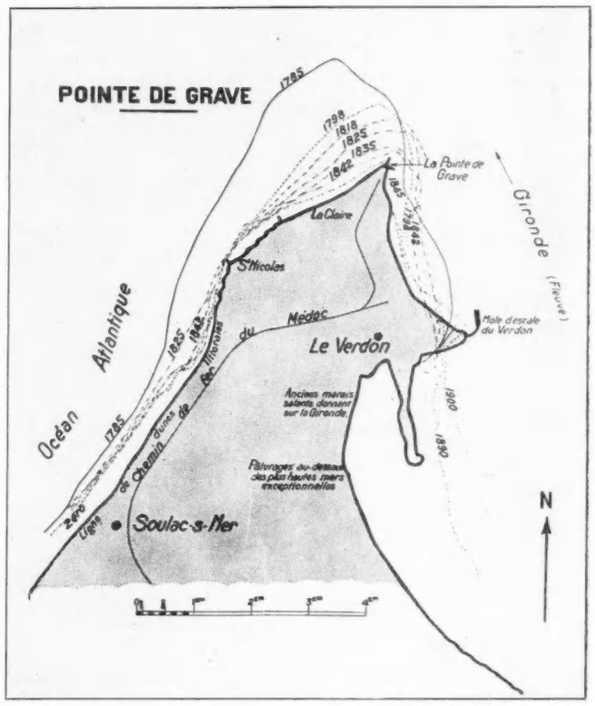
It is thus that, in a time probably not very distant (say the ninth or the tenth century) the rocks of Cordouan have been separated, on the surface only, from the rocks which are opposite to them at Saint-Nicolas, by the erosion in the intervening space not covered with sand. The secondary Pass called the South Pass, existing between Cordouan and Saint-Nicolas, supported on a side directed now from South-West to North-East, a pass at present neglected by navigation, is only an accident of erosion and therefore a simple accident of surface, a lutetian submarine pavement, erosion only showing itself in places and for several metres at the most in respect of the general substratum.

The Recession of the Coast at Pointe-de-Grave

The general rocky plateau that is met with from Saint Nicolas to Cordouan, was covered probably a relatively short time ago with deposits analagous to those which are now found on the actual exterior coast of Pointe-de-Grave; deposits of sand, more or less fine, more or less shelly, deposits of bluish or greenish clay of different ages, overlaid in turn by the sands of the dunes. When Cordouan was connected at low water with the Pointe-de-Grave, the whole constituted the southern bank of the external Estuary. This clayey, sandy projection has been attacked by storms from the south-west and has been caused progressively to recede. In fact, as we shall see later on, the clay has only a mediocre durability when it is subject to a succession of the dry and wet state, that is to say, above low water it disappears little by little and thenceforth the sandy mantle of beach or dune is deprived of a foundation. It is washed away and the coast line recedes towards the east under the action of storms, the most frequent of which come from the west.

There are then two types of visible erosion actually in the external zone of the Estuary; the erosion of the calcareous rocks by the pholades and the worms, and the erosion of clayey and sandy beaches by storms. The erosion by the pholades follows, moreover, immediately after the erosion causing disappearance of the clay.

There has been obtained certain precise information, relatively recent, which allows a determination of the speed of the resultant erosion and of the transport towards the east of the Pointe de-Grave. In 1630, the Peninsula of Grave was only 5 kilometres from Cordouan, while at the present time it is 7 kilometres (see the chart of Tassin of 1631, edition of 1633). The whole of the Atlantic coast at the Pointe has travelled towards the east and the actual littoral dunes cover a zone which fronted formerly on to the river, as do still the ancient salt marshes of Le Verdon.



Retreat of the Shore Line at Pointe de Grave.

In this zone, now external, are to be met the remains of vegetation and vestiges of the steps of cattle that the coast exposes to view—I have seen them myself on several occasions with my staff and I have taken moulds of them—after the abrupt recoil of the present external coast line under exceptional storms. Exact measurements taken between 1818 and 1846 have proved that in less than 30 years the Pointe-de-Grave has receded 720 metres towards the east; about 1843, when considerable defence works were undertaken, the recession of the coast line was on an average 0.13 metres daily; actually the shore line is fixed at this point and even advanced by breakwaters, which will probably be completed by large spurs, in concrete, unattackable by pholades; these spurs will be constructed on the rocky submarine bottom, such as that of Saint Nicolas and those off Pointe La Claire or even of Soulac-sur-Mer.

(To be continued).

Southampton Docks.

With the termination of the holiday season and the reduction of passenger movements on the principal ocean routes, it is now possible to ascertain the extent of the increase in ocean travel this year. Apart from the cross-Channel and continental traffic, which has provided evidence of marked revival, the movement of ocean passengers to and from Britain has been of record dimensions. This latter traffic has shown an advance of 11 per cent. at Southampton during the first eight months of 1937, as compared with the corresponding period of 1936. It is interesting to note that a report issued by the Travel and Industrial Development Association relating to the movement of holiday-makers visiting Britain from overseas during the same period, records a percentage increase similar to that shown above for this port.

Seasonal importations of citrus fruit from South Africa have this year exceeded all previous records. Southampton, which receives the major portion of the Union's fruit exports to the United Kingdom, has already dealt with two million packages of oranges, grapefruit, and other citrus varieties during the present season and thus, with two months still to go, has handled a greater quantity than in the preceding year.

Trawler-Bunkering Installation at Fleetwood

THERE has recently been carried out by the London, Midland and Scottish Railway Company an extensive scheme of modernisation and electrification of machinery at their docks at Fleetwood, the improvements being specially designed with reference to the provision of increased facilities for the Fishing Industry. In this connection, the question of the rapid coaling of trawlers has received particular attention, and the Company have now installed a series of six independent coaling appliances, each of 200 tons per hour capacity, specially designed and adapted for the requirements of fishing vessels.

Prior to the installation of the new appliances, the coaling of trawlers was effected either by means of steam cranes and buckets, hand-loaded from railway wagons, or by three electrically-driven transporter type cranes, handling buckets, also filled by hand, direct from railway wagons. All this old equipment has now been replaced by the six modern continuous belt-conveyor coaling appliances referred to above, supplied to the specification of Mr. W. A. Stanier, the Company's Chief Mechanical Engineer, by Messrs. Mitchell Engineering, Ltd. Three of these appliances serve the Wyre Dock and three the Fish Dock.

Since a battery of appliances of this nature can deal with considerable quantities of coal, it has been necessary to modify entirely and enlarge the wagon accommodation adjacent to the appliances, in order that the latter may be adequately supplied with coal, each appliance being arranged as an entirely independent unit, with adjacent accommodation for an average of 30 full wagons and 30 empty wagons, quite apart from the general and marshalling sidings.

The Lay-Out

Each plant, together with its accompanying sidings and equipment, is similar to any other in the group, thereby simplifying the operation of the plant and the transfer of operating staff from one to another as may be required.

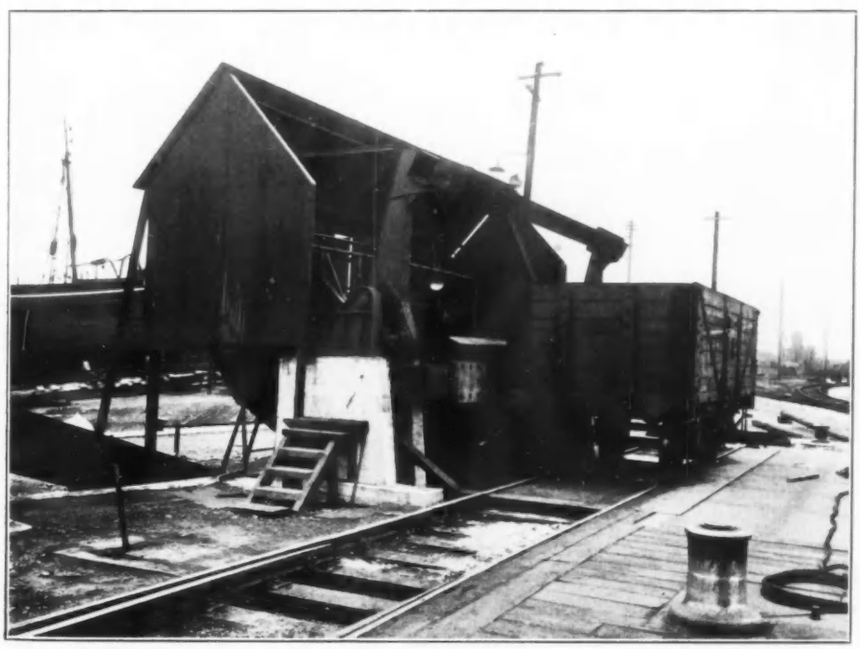
In the lay-out of plant of this nature, it is essential to provide adequate wagon-handling equipment for dealing with both the incoming loaded wagons and disposing of the empty wagons at such a rate that the full capacity of the plant can be made use of.

In the case of Fleetwood, each plant is served by an independent full wagon siding, together with an empty wagon siding, both tracks being laid parallel and graded up to the discharge point over a distance of 60 yards, at an average inclination of 1 in 90. The full wagon road is served by a vertical bollard haulage capstan, having the haulage rope permanently attached to the bollard and provided with a return tail rope operating over a weight applied tension gear. The lay-out of the capstans and sidings in relation to the plants may be seen in the plan.

The capstan is controlled from a cabin adjacent to the wagon tippler and, in addition, is provided with an automatic treadle-operated cut-out switch fixed approximately at the top of the incline, and so arranged that a wagon in moving on to the trip switch will automatically stop the capstan. In operation, the towing hook of the capstan is attached to the last wagon of a raft of, say, eight full wagons, all of which have been uncoupled. On starting the capstan, the raft is moved forward up the incline until the leading wagon engages the trip switch, thereby stopping the movement. From this point forward the leading wagon is moved on to the platform of the wagon tippler by means of a normal 1-ton capstan.

The empty wagon, after discharge, is dealt with by the same capstan, but is automatically switched by means of a spring-operated track switch to the empty siding, and this being on the down grade, the wagon is carried well clear of the cross-over point under gravity.

No. 4 Coaling Plant. Near View of Chutes on Trawler.



No. 4 Coaling Plant. Waggon in Tippler.

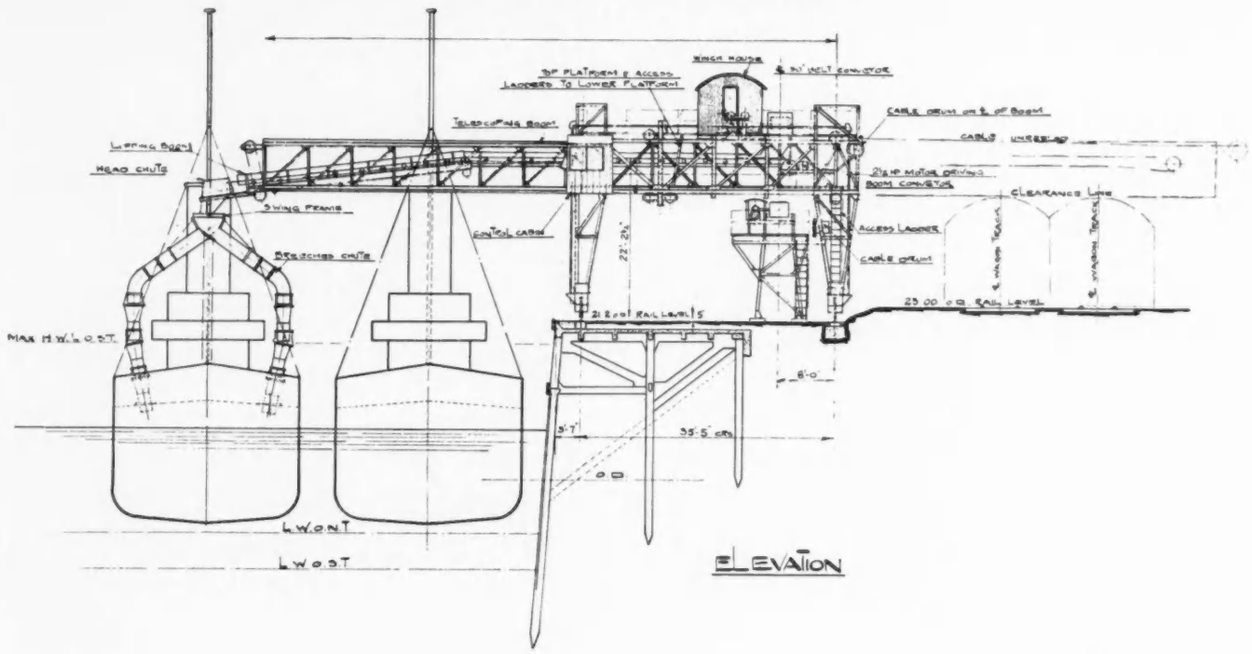
Turning now to the details of the actual coal-handling plant, it will be seen, on referring to the plan, that it consists in the main of a wagon tippler feeding an inclined belt conveyor which, in turn, delivers to a telescopic boom conveyor mounted in a travelling bridge structure, the boom conveyor being provided with a luffing motion and bifurcated shoots of a flexible nature for delivering coal to the trawler bunker hatches.

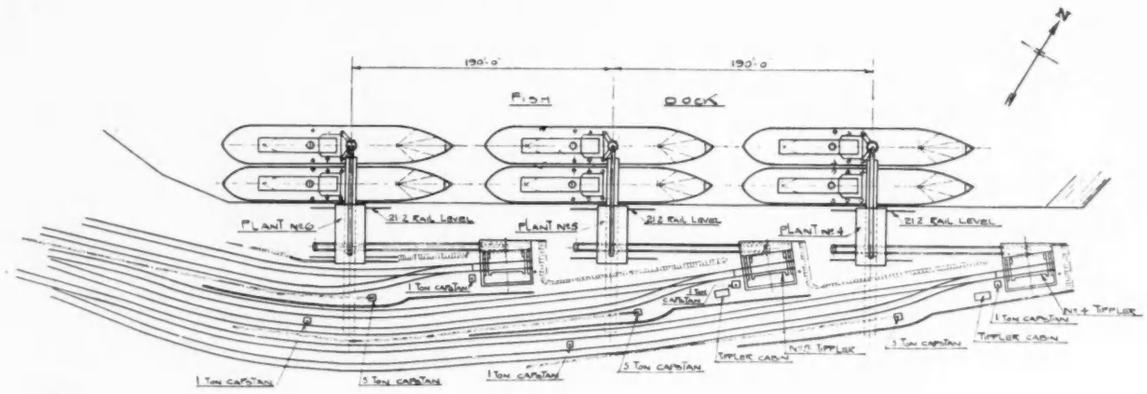
It will be seen also that the main inclined conveyor is arranged at right angles to the boom conveyor, the whole arrangement making a very compact lay-out in the space available.

The Tippler Apparatus

The tippler is of the side-discharge type, arranged for handling all sizes of wagons from 8 to 20 tons, the time required to tip a full wagon and to lower the empty wagon being one minute for each operation. The design follows Messrs. Mitchell's

Trawler-Bunkering Installation at Fleetwood—continued





MAIN CONVEYOR
30" BELT CAPACITY 200 TPH SPEED 300 FPM
BOOM CONVEYOR
30" BELT CAPACITY 200 TPH SPEED 320 FPM
SHUTTLING SPEED OF BOOM = 80 FPM
LUFFING SPEED OF BOOM = 14 FPM AT CONVEYOR HEAD
TRAVELLING SPEED OF BRIDGE = 40 FPM
WAGON TIPPLER - WAGON TIPPED IN 1 MINUTE

FISH DOCK - FLEETWOOD. TRAWLER COALING PLANT. GENERAL ARRANGEMENT.

general practice for this type of plant, the driving machinery being situated in a well-lighted and easily accessible machinery room forward of the tippler table and below rail level. A particular feature of the tipplers supplied for the Fleetwood plants is the fact that the whole of the tippler structure, cams, levers, beams and table are of welded construction throughout, all these items being built up from flats and plates.

The coal delivered by the tippler is received by a "W" form of hopper having an outlet on the inside face of each leg. Coal is extracted from the hopper by a double-acting jigger feeder each side, delivering inwards to a single outlet in the centre, this construction ensuring that the feed to the main belt is continuous and not intermittent, as would be the case from a single-acting jigger feeder. The capacity of the feeder is controlled by the length of the stroke, and this is adjusted to pass coal at the rate of 200 tons per hour.

The coal used for trawler bunkering purposes varies in size from "run of mine" to "duff," the bulk of the coal being in the form of a mixture of both large and small coal.

The plant and chutes have been designed to pass coal below 12-in. cube, and in consequence, when certain varieties of coal are being dealt with, it is necessary to break the large lumps by hand. For this purpose, the jigger feeder outlet is provided with a grid arranged to pass all coal below 12-in. cube, over-size lumps retained on the grid being broken by hand on the latter. This method would, of course, not be suitable where the proportion of over-size coal was large, but in the case under review, the system works very well. The question of dust prevention during dry weather has received considerable attention, and for this purpose, the hopper is fitted with a high-pressure water spray, the control valve for which is operated by hand from a position adjacent to the tippler control switch. The nozzles give a fine dense spray, which effectually lays the dust during the tipping operation, and also prevents dust arising at the intermediate transfer chutes.

The inclined belt conveyor, 30-in. wide, running at a speed of 300-ft. per minute, and having a carrying capacity of 200 tons per hour, calls for no special comment, other than that it delivers to the boom conveyor over a large travelling tripper, the latter being attached at its upper end to the bridge structure and moves with it, the lower end being supported on flanged wheels running on a track fixed to the horizontal portion of the main conveyor steelwork.

The Travelling Bridge

The travelling bridge structure is carried on four 2-wheel articulated bogies, running on rails at quay level and parallel to the edge of the quay. The total travel of the bridge is 40-ft. at a speed of 40-ft. per minute. One bogie on each leg is driven through shafts, and gearing from a motor fitted in the machinery room on the top of the bridge structure. Adequate screw-down rail clamping gear is provided on each leg, to be used whenever the plant is not in actual service.

The bridge structure supports, in turn, the telescopic boom having a motion at right angles to the quay, the total movement being 50-ft. The range of travel of the bridge in conjunction with the cross movement of the boom is sufficient to cover the bunker hatches of two trawlers lying abreast without moving the vessels.

Trawler-Bunkering Installation at Fleetwood—continued

The telescopic boom carries throughout its length the boom conveyor, the outer end of the latter being provided with a luffing motion, giving a total rise and fall of 14-ft., thus enabling vessels to be dealt with at all levels of water inside the dock. The luffing and telescoping motions are both operated by a single two-motor differential winch, fixed in the machinery room on top of the bridge structure. By compounding the luffing and telescoping motion in the differential winch, either one of the motions may be operated without affecting the other. Thus, in telescoping in or out, the winch automatically winds in or pays out the requisite amount of rope, so as to ensure that the angle of luff remains constant throughout the full range of motion of the boom.

Near View showing Coaling of Trawlers at Wyre Dock.

Distribution of Coal to Hatches

The coal delivered by the boom conveyor is distributed to the trawler bunker hatches by the double-wing chutes seen in the various illustrations. The centre section of the chutes is carried on a series of ball-bearing rollers, attached to a swinging frame pivotted to the end of the boom conveyor. The chutes can, therefore, be easily rotated, and at the same time adjust themselves to the vertical independently of the position of the luffing boom. The centre section also incorporates a valve for diverting the stream of coal down either leg of the chute, but is so arranged that it cannot be left in the central position. This valve is normally under the direct control of the leading trimmer from a position on the ship's deck, and it is one of his duties to deliver the coal on either side as may be required, the change-over being made frequently during the process of coaling without stopping the plant.

In order to complete the connection between the outer end of the bifurcated chute and the hatch openings, a number of portable sections are provided, which may be attached as desired to form flexible connecting chutes of the requisite length.

Control

The tippler is under the direct control of the tipplerman, and his duty is to see that a supply of coal is always available in the tippler hopper throughout the period of coaling a trawler. The whole of the remainder of the plant is under the control of the plant driver, from a cabin mounted on one of the outside legs of the travelling bridge, approximately at the height of the telescopic boom, the master controllers for the various motions being conveniently situated to the hand of the driver. The main protective panel, also for the whole of the plant other than the tippler, is mounted in the driver's cabin, the tippler and capstan panels being mounted in the tippler cabin. Both main and control connections between the fixed and moving portions of the structure are dealt with by multi-core flexible cables and spring-loaded reeling drums, thus avoiding a multiplicity of bare conductors and the accompanying collector gear.

The various motions of the feeder and belts are closely interlocked to ensure that any failure will result in the minimum amount of damage to the plant, and ensures that all motions prior to a stopped or damaged motor will be automatically stopped. In addition, the plant is fully protected by emergency stop switches fixed in prominent positions throughout the plant. The result of pressing one of the stop switches is to stop the whole of the plant, and it is not possible to re-start until the reset button on the side of the stop switch which caused the original stoppage has been operated.

It is stated that the plants have proved themselves to be an efficient method of coaling fishing vessels, the bifurcated chutes especially enabling the vessels to be trimmed with ease and rapidity.

Legal Notes

Harbour Authorities' Craft and Passenger Transport

(By our Legal Correspondent)

Lloyd's List of October 2nd contains a report of the proceedings at Poole Police Court, when the Poole Harbour Commissioners were fined fifty guineas for an alleged infringement of the provisions of the Merchant Shipping Act relating to the survey and certification of passenger steamers.

The occasion giving rise to the proceedings was an excursion by the Poole Harbour Authority's steamer "Shifter," with a party, numbering about a hundred persons and comprising members of the Harbour Board, their relations and friends, to see the Coronation Review at Spithead. The prosecution alleged that the "Shifter" was, so far as this trip was concerned, a passenger steamer within the meaning of the Merchant Shipping Act 1894, and should, therefore, in compliance with Section 271 of the Act, have been surveyed and certified by the Board of Trade.

The principal charge was against the Master of the vessel, the Commissioners being summoned for aiding and abetting, but the view was taken that the Captain, as the servant of the Commissioners, had to obey their orders and that the Commissioners were in fact the principal offenders. A nominal fine of one pound was therefore imposed on the grounds, it was submitted, that the offence was merely technical.

There have been from time to time several decisions of the Courts bearing upon the points raised. Notably, in the case of "Kiddle v. Kidston," the circumstances were very similar, except that a Harbour Authority was not involved. There, the tug steamer "Flying Hawk," owned by her master, and being without a Board of Trade certificate, went on a pleasure excursion, carrying more than twelve passengers, who were invited by the owner, and none of whom paid anything. It was decided, on appeal from the Magistrate, that on such evidence the owner and master ought to be convicted.

There would have been no contravention of the Act by the Poole Harbour Board if the "Shifter's" complement had consisted entirely (apart from the officers and crew) of members of the Harbour Board and their families and servants. The "Shifter," unfortunately, carried friends as well, and there is a difference between servants and friends, although it may not always be easy to distinguish.

A general legal principle applicable to all Harbour Authorities seems to be involved in the present case, apart from the special points already considered. Harbour Authorities are statutory bodies, having certain definite powers and duties. A trip to witness the Naval Review clearly does not come within the statutory activities of Harbour Authorities, and, if undertaken, may result in a rap on the knuckles for the organisers No one would desire to restrain a little innocent relaxation on the part of the members and officials of Harbour Boards, but the suggestion is put forward that before engaging in an undertaking outside the scope of the statutory powers, it would be as well to take advice as to the manner of proceeding.

South African Railways and Harbours Board

Excerpts from Report for Year ended 31st December, 1936

Harbour Development: Table Bay

The phenomenal increase in traffic at Table Bay Harbour in recent years, particularly petrol and oil, and the visits of larger ships, combined with the lack of room for expansion, has rendered extensive harbour development and foreshore reclamation imperative. The scheme which has been adopted after protracted negotiation with the responsible public bodies, will involve a capital outlay of close on £6,000,000.

In view of the necessity and urgency of the contemplated extensions at the harbour, an amount of £2,260,844 has been included in the Capital and Betterment Estimates for the financial year 1937-38, covering the following works:—

Description of Work.	Estimated Cost. £
(a) Construction of "E," "F," and "G" berths complete with shed and crane equipment, excluding land filling and dredging	773,268
(b) Construction of new random block mole	267,190
(c) Removal of existing mole	50,000
(d) Construction of temporary pile embankment	50,000
(e) Reclamation of land, including filling behind new berths "E," "F," and "G"	1,120,386
Total	£2,260,844

Of the above total it is estimated that some £525,000 will be expended during the current financial year, while the sections of the work provided for, which it is anticipated will require approximately four years to complete from the date of commencement, constitute a substantial proportion of the comprehensive scheme for the development of the harbour.

The principal sections of the remaining work incorporated in the scheme, but which it is proposed to hold over for construction in future years, together with the estimated cost thereof, are as under:—

Description of Work.	Estimated Cost. £
(a) Removal of rock eastwards beyond end of berth "G"	199,379
(b) Quay walls: approximately 10,400-ft. or equivalent to 12 additional berths	1,219,242
(c) Additional reclamation	152,158
(d) Surfacing of quays and drainage, water supplies and electric light, railway and crane tracks, roadways and storm water drainage	256,789
(e) Single-storied cargo sheds (12)	125,893
(f) Cranes: 60 erected, complete	158,013
(g) New graving dock, complete	1,605,281
Total	£3,716,755

If the work proceeds normally, i.e., with special acceleration or serious interruption, it is expected that the entire scheme will take from eight to nine years to complete, but when finally completed, Capetown will have as up-to-date and well equipped a harbour as can be found anywhere in the world.

Pre-cooling Facilities

The tonnage of fruit exported during 1936 totalled 253,262, an increase of 33,588 tons or 15% over the 1935 figure. Deciduous fruit exported through Table Bay Docks advanced from 68,510 to 83,473 tons, an increase which indicates that the steps taken to augment and modernise the pre-cooling facilities at that port by building what are probably the largest pre-cooling stores of their type, were amply justified.

The new-precooling store at Port Elizabeth, of which the first portion was placed in commission during March, 1937, is expected to be in operation next month. Citrus exported during the year at this port increased by 7,961 tons and at East London by 7,051 tons to 15,315 tons, which, however, is still nearly 5,000 tons below the annual tonnage expected prior to the completion in 1936 of a new pre-cooling store at Buffalo Harbour at a cost of £82,000.

Grain Elevators

Acting on the recommendation of a committee appointed by the Government in 1918 to investigate the desirability of establishing a grain elevator system in the Union, the Administration decided to erect the following elevators, the capital cost involved to date being approximately £2,557,254:—

	Capacity Tons
1 Port terminal elevator, Durban	42,000
1 Port terminal elevator, Capetown	30,000
1 Country elevator, Western Province	2,600
15 Country elevators, Orange Free State	57,000
19 Country elevators, Transvaal	51,300
Total: 2 Port terminal elevators and 35 Country elevators	182,900

Harbours

The total capital expediture (including lighthouses) at 31st December, 1936, was as follows: Interest-bearing £16,028,966; non-interest-bearing, £1,544,957, making a total of £17,573,923.

Cargo dealt with (import and export), 8,815,370 tons.

The revenue was £2,013,696, and expenditure £1,368,423.

The Administration has recently decided to reduce the port dues on ships calling at Union harbours by 50%, involving a concession of approximately £148,500 per annum, based on the estimated earnings under this head for the financial year 1937-38.

Photo] ***Durban: General View of the Docks at the Point.*** [South African Railways and Harbours

Financial Results

The working of the harbours of the Union and South West Africa resulted in a surplus of earnings over gross working expenditure of £1,167,982 for the year.

Ordinary working expenditure amounted to £663,378 and depreciation charges to £100,533, giving a total of £763,911, or £46,788 in excess of the 1935 figure.

After taking into account interest charges of £560,860 and other miscellaneous receipts and charges (a credit of £15,375), together with a surplus of £22,780 on lighthouses, the net result of working was a surplus of £645,271, an increase, compared with 1935, of £162,987, or 33.8%.

IMPROVEMENTS

Table Bay Harbour

The construction of the new pre-cooling store at berth "C," South Arm, New Basin, proceeded at a rapid pace throughout the year and the facility was brought into commercial operation on the 18th December, 1936. It has since been decided to insulate the ceiling of the air lock, and this work is nearing completion.

The pre-cooling store, which is capable of storing 4,000 tons of chilled fruit, is to be connected by means of an overhead gallery to the top storey of the sheds at Nos. 3 and 4 berths, South Arm, which will be insulated and will provide storage for an additional 1,000 tons of chilled fruit. The steelwork for the gallery has not yet arrived from overseas, but as soon as it comes to hand the construction of the gallery and the insulation of the space in Nos. 3 and 4 South Arm sheds will be proceeded with.

Port Elizabeth Harbour

The first portion of the new pre-cooling store of 4,500 tons capacity at No. 2 quay was placed in commission on 15th March,

South African Railways and Harbours Board—continued

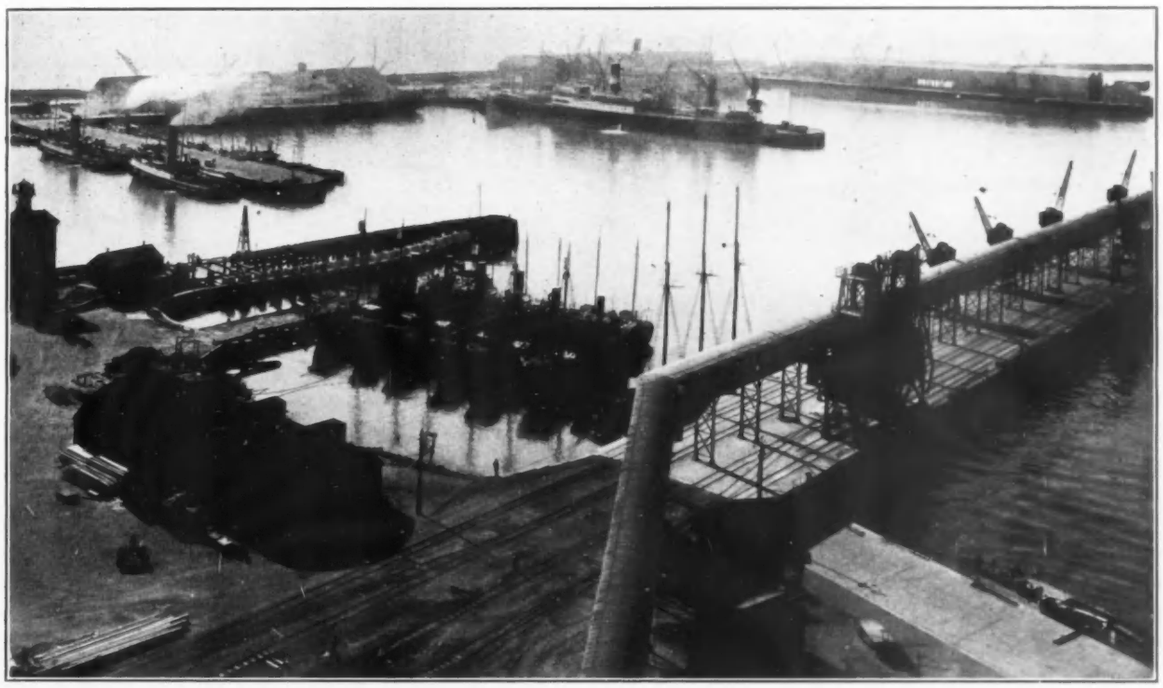
1937. The installation consists of two stores, each consisting of eight cooling chambers, receiving air-lock, and shipping gallery, the whole of which is situated below ground, including all operating machinery and the necessary railway tracks serving the installation.

The opening of the first portion of this facility will permit of the use of insulated lighters in connection with the shipment of fruit being dispensed with, and as such, this event is an important step in the development of the harbour, coinciding as it does with the opening of the shed for cargo working on No. 2 quay.

ing bank 343-ft. in length for motor cars, and the reconstruction of the former Shark Jetty for use by whalers.

Port Elizabeth Harbour

The extension of the Charl Malan Quay (No. 1) to its full length of 3,540-ft. was effected during the year. Berths Nos. 1, 2, 3, 4, and 5 on this quay were completed, equipped with sheds, cranes, capstans, road and rail facilities, and brought into full use.



Photo] *Capetown.* [South African Railways and Harbours

The Upper Portion of the picture shows the East Pier and Two Jetties of the Victoria Basin. In the foreground is the Coaling Jetty and above No. 4 Jetty is seen the Conveyor Gallery from the Grain Elevator.

East London Harbour

The new 1,500 ton capacity pre-cooling store situated at the recently-constructed No. 6 quay in the eastern wing of the C. W. Malan Basin was opened for commercial operation on the 2nd June, 1936, and during the period June-October, 1936, nearly 12,000 shipping tons of export citrus fruit were handled by this store.

NEW WORKS

The new works at the harbours of the Union, completed during the year and in progress or under consideration at the present time, are as follows:—

Table Bay Harbour

The construction of the deep-water berth " D " at the knuckle in the new basin was completed during the year.

Six cranes have been provided to work the new quay, which was brought into commercial use on the 25th February, 1937.

The question of providing, under the long-range scheme of development, all-weather deep-water berthage in the new basin at Table Bay Harbour additional to the facilities provided by " D " or knuckle berth referred to above was considered by the Administration early in 1936, and, as a result, approval was given for the construction of the first of the new berths (" E ") at the southern end of the basin under the new scheme for the future development of Table Bay Harbour.

Approval was also given to the transfer of the fishing harbour from the site in the new basin to a position in the Alfred Basin of the old dock. The removal of the fishing harbour from the new basin was necessary in order to make room for the construction of " E " berth.

Durban Harbour

Authority was given during the year for the construction of additional deep-water berthage, 1,425-ft. long. Approval was also given for the removal of the cant of the North Pier.

Other works undertaken and completed at Durban Harbour during the year included an extension of 210-ft. by 40-ft. to " G " shed and the provision of an additional 5,618 sq. feet of concrete platform; an extension of 138-ft. by 136-ft. to the bond store for the purpose of storing maize; the construction of a loading

The work of reclaiming and equipping the area behind the new berths Nos. 6 and 7 proceeded satisfactorily.

As mentioned in last year's report, it has been decided to extend No. 2 quay by 450-ft. to a total length of 1,700-ft. so as to enable two of the largest vessels to be accommodated thereat simultaneously. This extension was completed during the year and 1,675-ft. of quay wall were provided with reinforced concrete deck slab and crane rails.

The rubble stone protecting mole, approximately 5,000-ft. in length, was completed, while the closing in of the Dom Pedro Jetty had virtually been completed at the close of the year.

East London Harbour

The new 1,000-ft. quay wall in the eastern wing of the C. W. Malan Turning Basin was brought into commercial operation on the 22nd January, 1936, and the turning area in front of the quay was likewise made use of.

Further Extensions at Durban Harbour

The following additional information concerning further developments at Durban Harbour has been received. Six new deep-water berths will be provided by the construction of a projecting wharf, starting from the end of " I " wharf. This will occupy the site originally intended for one of the two deep-water berths which were to have been provided as an extension of the existing wharf facilities. The other deep-water berth now under construction will not be affected by the new scheme.

The new wharf will extend 1,980-ft. on its longer side and 1,700-ft. on its shorter, and will make an angle of approximately 80 deg. with the main wharf. The deep-water berth now under construction below " I " shed will be used for coastal craft, and will include a new shed, 400-ft. long and 50-ft. wide. The new projecting wharf is to be 675-ft. wide, and four capacious sheds will be erected on it, two of them measuring 600-ft. by 120-ft., and the other two 540-ft. by 120-ft. They will be separated by two roadways with railway tracks in the centre. It is anticipated that all six berths will be available within five years.

Centenary Celebrations at Granton Harbour

A Flourishing Scottish Port Undertaking

The centenary of the construction of Granton Harbour, in 1837, was fittingly commemorated on September 17th, with the laying of the foundation-stone of the new coaling berth at the Middle Pier, by the Duke of Buccleuch, who was accompanied by the Duchess of Buccleuch, Lady Elizabeth Scott, and the Earl of Dalkeith.

The Duke said it was a great pleasure to him and to his family, and to those associated with the management of Granton Harbour, to meet so many of those who had a connection with the harbour. Much had happened in the history of Granton since 1837, and he thought the position of the harbour, its trade, and its condition to-day were a testimony to the foresight of those who planned it and carried out the work. It would be agreed, he said, that a small harbour like Granton could not stand still. They must go forward, and he hoped the new venture would meet with success. The ceremony was a simple and modest one, but he hoped it would herald in a new period of a hundred years of prosperity to the harbour and useful service to the district and traders who used it.

His Grace was then handed a silver trowel and an ivory mallet, with which he performed the ceremony, concluding by declaring the stone well and truly laid. The stone was dedicated by the Rev. T. M. M'Farlane, Granton Parish Church, after which a number of interesting presentations were made to employees with 25 years' service and over. The company then boarded the steamer "Fair Maid," where luncheon was taken and speeches were made by the Duke of Buccleuch, who presided. Mr. T. M. Cooper, K.C., M.P., the Lord Advocate, Lord William Scott, a Director of Granton Harbour, Ltd., Bailie Coltart Sir John H. Milne Home, Mr. A. E. Jones, and Mr. John A. Lindsay, Chairman of Leith Dock Commission.

Photo by courtesy of] ["The Scotsman and Evening Dispatch."

Early History

Granton Harbour has already formed the subject of a detailed descriptive and illustrated article, which appeared in "The Dock and Harbour Authority" for June, 1935. It is not necessary, therefore, so soon thereafter, to recapitulate the information. But as the present occasion is one of historical interest, it may be considered appropriate to make some reference to the early records of the undertaking. The following passages have been extracted from a centenary publication issued by the Company and compiled by their General Superintendent and Engineer, Mr. J. H. Hannay Thompson.

The granting by William IV. upon the 21st day of April 1837, of his Royal Assent to "an Act to enable the Duke of Buccleuch and Queensberry to make and maintain a pier at Granton, in the Parish of Cramond, and a road therefrom to join the road leading from Leith to Queensferry, in the County of Edinburgh," marked the culmination of many years of preliminary discussion and investigation into the possibilities of improving Edinburgh's connection with the sea and, at the same time, officially constituted Granton as a harbour.

Although this marked Granton's official recognition as a harbour and landing place, its history stretched back through the centuries, and was as varied and colourful as that of any other place in the Forth. The rugged coastline of Granton, notwithstanding the comparatively sheltered situation, was the scene of several notable shipwrecks, recorded in early times. Bower mentions that in October, 1425, a great "carrick" of the Lombards was shattered on the rocks at a part where, about fifty years ago, some ancient Italian guns were discovered. The Leith ship "Jonas," then regarded as a leviathan of commerce, met a somewhat similar fate during a storm in 1579.

When the English army marched on Leith under the Earl of Hertford in 1544, they landed at the exact spot where the harbour is now situated. On the night of the 3rd of May the English fleet came to anchor near Inchkeith, and the following day the landing was effected, practically without opposition.

Granton's stone quarries also appear to have been of ancient origin, for it is recorded that for licence to "wyn stanes on his lands of Granton to the schoir for the hale space of a year," half an ell of velvet was in 1552 paid to the Laird of Carube.

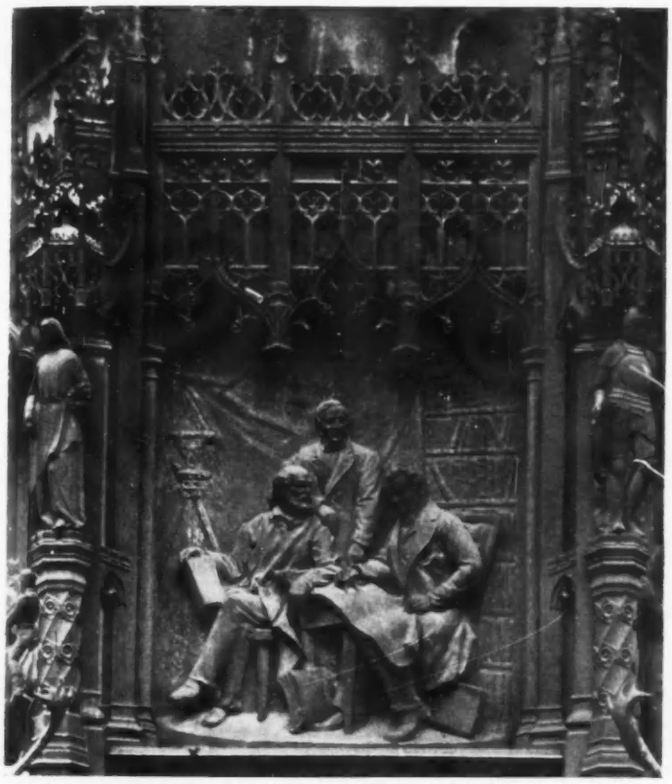
The lands of Wester Granton were disposed in 1636 by Charles I. to Sir Thomas Hope of Craighall, with right and privilege of free harbour and shore, and of founding and building a harbour thereon, which charter was renewed in 1643. These lands, along with Easter Granton, subsequently came into the hands of John, Duke of Argyll and Greenwich, and were inherited by his eldest daughter, Lady Caroline Campbell, Countess of Dalkeith, thereby becoming an adjunct of the lands of the House of Buccleuch.

Inception and Commencement

It was, however, during the years prior to and immediately following the suspension of payments by the City of Edinburgh in 1833, that interest in Edinburgh's maritime connections was at fever pitch throughout the city. At that time the city owned the Port of Leith, but through heavy dues, inadequate facilities, and the large sandbanks at its entrance, Leith was unable to supply Edinburgh's needs, and owing to the financial difficulties in which the City was placed, there did not seem to be much prospect of improvement in those facilities, or the removal of the sandbanks to a sufficient extent to make navigation possible, had the means by then been invented.

Centenary Celebrations at Granton Harbour—continued

Many rival schemes were proposed for the improvement of Edinburgh's harbours, amongst them one for providing a new entrance to Leith Docks from the west, a second, the constructing of an entirely new harbour at Trinity, and the third, originally proposed by Mr. R. W. Hamilton, Manager of the General Steam Navigation Company, to construct an entirely new harbour in the deep water at Granton. At that time vessels had to lie in the roads and send their passengers ashore in small boats, but in view of the great increase in the number of passenger steamers plying to the Forth, a landing place at which passengers could disembark at all states of the tide was urgently required. Mr. Hamilton's views were communicated to the Duke of Buccleuch, who held, along with property at Granton, the rights of foreshore and harbour. His Grace evinced immediate interest in the scheme and gave instructions for the necessary estimates and reports to be prepared, and upon the 22nd day of May, 1834, Robert Stevenson & Son, Civil Engineers of Edinburgh, presented a report recommending the construction of a tidal harbour upon His Grace's lands.



Walter Francis, Fifth Duke of Buccleuch, considering Plans for Granton Harbour with his Advisers.

This group forms one of the panels on the plinth of the statue of the Fifth Duke which is situated to the West Door of St. Giles' Cathedral, Edinburgh.

The opposition between the rival factions already referred to was extremely strong, and Mr. Thomas Telford, first President of the Institution of Civil Engineers, had been commissioned by the Government to report upon the position, and in April, 1835, he expressed the opinion that if " steamboat piers were made convenient and safe for landing and embarking at all states of the tide, and the road from Burntisland through the county of Fife put into a proper state for a mail-road, there can be little doubt that the intercourse with the populous east coast of Scotland, including the towns of Cupar, Dundee, Arbroath, Montrose, Stonehaven, Aberdeen, Peterhead, Fraserburgh, Cullen, and Banff, would be by Dundee and Burntisland to Edinburgh, avoiding the present circuitous route by Perth and the Queen's Ferry." At Granton there was, at a short distance from the shore, a depth of water considered at that time ample for all purposes, and Granton was the closest point to Burntisland, the recognised place upon the Fife shore for communication with Edinburgh.

His Grace, however, " having no intention of undertaking a measure unless it could be shown to be consistent with . . . the general interests of the district," first called upon Mr. James Walker, F.R.S., President of the Institution of Civil Engineers, to report fully upon the various schemes of harbour improvement which had been proposed by the many persons interested. Mr. Walker decided that after a consideration as full and impartial as he had been able to give the subject, he could see no way in which a remedy to the present difficulties could be applied so economically, so expeditiously, and with so little interference with existing interests and rights as the construction of a harbour at Granton.

The whole of these reports and estimates were submitted to and approved of by a meeting of " Mercantile and Nautical Gentlemen " held in Edinburgh under the Presidency of Admiral Sir David Milne, and His Grace, convinced of both the practicability and necessity of the proposed undertaking, intimated that he himself would bear the entire expense of the works.

The promoters of the Trinity scheme first brought their Bill before Parliament, but it was rejected by the House of Commons in 1835. The Granton Bill was introduced in 1836 and, after many delays, finally received the Royal Assent in the following year.

The Middle Pier

His Grace, being impatient to get on with the works once his mind had been made up, did not wait until formal Parliamentary sanction had been obtained, as he was satisfied that in view of the terms under which the original grant of the lands had been made from the Crown, such sanction was unnecessary. He decided to adopt a scheme for a low-water landing pier situated upon the Oxcraig rock, to the designs of Robert Stevenson & Son, Engineers of Edinburgh, the well-known Lighthouse Engineers of the period, and at the beginning of 1836 the Contract was placed in the hands of George Johnstone & Company of Craigleith Quarry. From the start, considerable difficulties were experienced, and after the lapse of a few months, and before any real progress had been made with the works, Messrs. Johnstone requested to be relieved of their obligations. To this request His Grace agreed, and at the same time he decided to entrust the design and supervision of the works to Messrs. Walker & Burgess of London, and the Contract for the construction of the pier to their new design was placed in the hands of Messrs. John Orrell & Company, Contractors of Liverpool, on the 10th November, 1836, the formal Contract being entered into on the 24th February, 1837, when the works were actually commenced, the Royal Assent to the Act being given two months later.

The section of the harbour which now comprises the Middle Pier was the first to be built. It was carried out in sections, and the first section was completed and formally opened upon the 28th June, 1838, the date of Queen Victoria's Coronation, and named the Victoria Jetty in her honour. Two further sections were completed in turn until the Middle Pier was finished at its present length of 1,700-ft. in October, 1844.

The pier, and for that matter, both the breakwaters, were almost entirely constructed from sandstone from His Grace's quarries upon the Granton Estate, although a certain number of the larger facing blocks were brought over from Fife.

The foundations and under-water work were all carried out by means of a diving bell, the masonry blocks at the shoreward end being keyed to the rock itself, and, at the seaward end, founded upon the boulder clay.

At the present time the pier is 1,700-ft. long and 200-ft. wide on the average, and has a depth of water up to 13-ft. below low water of ordinary spring tides. The new works which are presently under construction are a further continuation of this pier.

The Breakwaters

Although admirably suitable for berthing the vessels of that period at all states of the tide, it was discovered that the Middle Pier was not sufficiently well protected from storms, particularly when the prevailing westerly winds were blowing strongly. It was therefore decided to enter into a much more ambitious scheme of providing, not only a landing pier, but a harbour of refuge as well.

The Act for the construction of this harbour was obtained in 1842, and the work was commenced shortly after. The western breakwater was the first to be formed owing to the greater prevalence of the westerly gales in the Forth, and the liability of the ebbing tide to form deposits of sand at the pier, carried from the beach and sandbanks higher up. This breakwater was undertaken in two contracts. The first projected in a nearly straight line from the shore in an east-by-north-east direction, almost parallel to the pier, and about 750 yards to the westward of it. The first section—about 1,500-ft. in length—was finished in 1849, when the contract for the second section was taken up. The second section, which is the longer, after turning an easy curve, runs east-by-south-east, forming a slightly obtuse angle with the first section. The total length of the western breakwater is about 3,100-ft., or nearly three-fifths of a mile. The breadth of the breakwater at the level of high tide is 24-ft., but at the base (about 31-ft. deep) it is in some parts no less than 140-ft.

The eastern breakwater was commenced in 1853, and was begun from its seaward extremity. The outer portion, about 1,000-ft. in length, was taken first in order to complete the

Centenary Celebrations at Granton Harbour—continued

protection to the western part of the harbour, which was still exposed to the north-east gales. A temporary timber bridge was carried from the extremity of the west breakwater, across which the building materials, from the quarries on the Granton Estate, were conveyed to the site of the works. During the construction of this part of the breakwater, vessels had to take the shore end of it, and on its being finished, the bridge was cleared away, and the proper entrance to the harbour was opened. The remaining portion of the east breakwater, about

Granton Harbour in 1855, from a contemporary print.

2,170-ft. in length, was carried out from the shore, and this large and final portion of the work was completed by the end of 1863. This breakwater was slightly larger in cross section than the western breakwater, being 25-ft. wide at the top and 150-ft. wide at the base at the deepest part, where the height is 33-ft.

The first section of the east breakwater was carried out by Alexander Wilson, Contractor, of Edinburgh, and the second section by Taylor Shipley Hunter of Newcastle-on-Tyne.

It is interesting to note that since the time of their construction, these breakwaters have stood firm and have required no maintenance or repairs whatsoever.

Much of the stone was taken from quarries situated on the adjoining Granton Estate. The first quarry was that next to Caroline Park gate, but the stone obtained there was not found at the time to be very suitable. The big quarry on the shore at Granton point was then opened and continued to be worked for a long series of years, and from this most of the materials were obtained until it was inundated by the sea on the morning of 26th October, 1855. The heavy sea breaking on the rocks which formed the protection of the quarry, together with an unusually high tide, overthrew the barrier and filled the vast basin of the quarry, most of which was below water level, in the space of five minutes. Fortunately, the occurrence did not take place in working hours, so there was no loss of life, although had the breach occurred a few hours later, at least sixty men would certainly have lost their lives. At the time of the accident the quarry had been wrought to a depth of 80-ft. below low water, and a basin of about five acres in extent was formed by the sudden and irreparable breach. The line of the old quarry can still be clearly seen upon the foreshore, looking like a derelict harbour, although it has now been partially filled in with ashes from the Edinburgh Gas Works. Another of the quarries, after it had been worked out, was converted into a reservoir, which supplied the Granton district with water until a few years ago.

The Ferry

On the 30th June, 1842, the Royal Assent was given to an Act for constructing a low-water pier and the necessary works at Burntisland in the County of Fife, and establishing a ferry between the same and Granton. This pier was built and the ferry operated by the joint enterprise of the Duke of Buccleuch and Mr., afterwards Sir John, Gladstone of Fasque, the father of the famous Prime Minister. The Act authorised the transference of the Fife and Midlothian Ferry from Newhaven and Pettycur to Granton and Burntisland, the new route shortening the sea journey to Fife by about two miles. Two " excellent steam boats " were put upon the passage, and the service continued to be run under the superintendence of a Mr. Peter Work until the end of 1846, when the direct interest of the proprietors in the undertaking was transferred to the Edinburgh and Northern Railway Company. The opening up of the railway system throughout the country and the establishment of railway connections on both sides of the Forth, affected Granton like other harbours in a double way. It, of course, greatly augmented the importance of Granton Pier as a ferry because Granton became an important link in the East Coast route to Aberdeen, as, until the construction of the Tay and Forth Bridges, the East Coast route ran from Edinburgh to Granton, by ferry to Burntisland, through Fife to Tayport, by ferry to Broughty Ferry, and on to Aberdeen. It is not our place to trace the development of the ferries, but it is interesting to note that the first train ferry service in the world in which trucks were run on to rails laid upon the steamers, was instituted upon the Granton/Burntisland ferry in the year 1849 with the introduction of the paddle ferry steamer " Leviathan."

GRANTON PIER.

THE PIER erecting by the Duke of Buccleuch and Queensberry, at the shore of Easter Granton, near Edinburgh, being now so far advanced as to afford accommodation for a limited number of Shipping, it is intended that the first Jetty or Landing Place, on the west side (now nearly completed, with Shade-Warehouse, Cranes, &c.) and also the West Quay, shall be opened on THURSDAY the 28th day of June current, and from and after that day be offered to the Public for the ordinary purposes of trade.

The depth of water at the first Jetty is as follows:—

Ordinary Spring Tides.

Low water, 7 feet. | High water, 24 feet.

Neap Tides.

Low water, 11 feet. | High water, 20 feet.

Before the 28th current, heavy Moorings will be laid down for the better security of Shipping, and a Light-house placed at the outer extremity of the Pier.

The new road, leading directly from the Pier to Edinburgh, will be ready about the same time.

Arrangements will be made to have at all times a proper supply of Coaches, Omnibuses, and other Vehicles, to ply betwixt Edinburgh and the Pier, under such regulations as to secure the proper accommodation and comfort of Passengers, and particularly to prevent any confusion or disturbance on the arrival or departure of Steam Packets.

Information as to the Pier Dues and other particulars will be communicated by Captain Bain, late of the Monarch Steam Ship, who is appointed Pier Master, or in his absence by Mr Fraser, the Resident Engineer.

Granton Pier Office,
20th June 1838.

PORTERS WANTED FOR GRANTON PIER.

WANTED, a PERSON of respectability who will Contract to furnish a sufficient number of PORTERS for the Pier, and find security for their good behaviour. It is intended that the Porters shall be sworn in as Constables.

Granton Pier Office,
20th June 1838.

Original Advertisement of Opening of Granton Pier.
From "The Edinburgh Evening Courant," 20th June, 1838.

The growth of the railways naturally led to a considerable diminution of the coasting traffic and the cessation of some of its branches altogether, but it appears that, in spite of this, the trade of Granton steadily increased, as the following quotation from the " Edinburgh Evening Courant " of Wednesday, 25th November, 1863, shows:—

> " The splendid steamers of the General Steam Navigation Company had now to compete not merely with their old rivals going out from Leith port, but with a new system of transit of unparalleled and almost undreamt-of speed, and of infinitely greater certainty as to the time of the journey. The steamers to Dundee, Montrose, and other

Centenary Celebrations at Granton Harbour—continued

ports then sailing from Granton kept up the competition for some time with the 'Edinburgh and Northern Railway' as it was then called, but gradually the railway so absorbed the Fife and Forfarshire traffic that the vessels were one by one withdrawn from the passage, to the no slight detriment of the public, however, in the matter of cheap fares. But the sea trade with the northern peninsula and islands of Scotland has to this day been left almost intact by the iron-horse, and the greater expense of railway transit will probably always secure a large traffic, especially in heavy goods, on the London sea-passage. In spite of the railways, therefore, and in some respects helped by them, Granton Pier is as busy as ever, and its wharves and warehouses are as crowded; and, in connection with the other parts of the undertaking which we have still to notice, the port is year by year taking an increasing share in the commerce of the country."

The ferry at this time was one of the main sources of the prosperity of the port, the numbers of passengers carried amounting to nearly 400,000 in a year.

New Coaling Jetty

The works which are now under construction, comprise the complete installation of a new coaling berth and a new jetty, which will be 450-ft. long. The type of construction is that of an open reinforced concrete jetty founded upon 14-in. by 14-in. reinforced concrete piles driven into the rock, the front being constructed of cylinders 3-ft. 6-in. in diameter, placed at 25-ft. centres. These cylinders will be founded on the actual rock, which has already been dredged out so as to give a depth of 25-ft. below Granton datum, which is 6-in. below L.W.O.S.T.

The presence of a reef of hard sandstone rock close to the surface of the ground was known and has been partially responsible for the design, which incorporates heavy mass-concrete roundheads at the ends of the jetty. These roundheads will be faced by built-up Greenheart fenders back with rubber, the whole to have a certain measure of flexibility as it is anticipated that owing to the concentration of trawlers at the harbour, it is probable that many vessels will come in contact with the ends, especially when moving from one side of the Middle Pier to the other.

The coal conveyor, which is designed with a view to reducing the breakage of coal to a minimum, is also specially adapted for the bunkering of trawlers, and will be capable of delivering up to 600 tons of coal per hour.

It is expected that the whole of the new works will be completed and in working order in less than two years.

Port of London Registration Committee

Excerpts from Annual Report for the Year 1936

Introduction

This report on the work of the Port of London Registration Committee covers the 12 months ended 31st December, 1936.

The policy of limiting the number of Registered Port Workers in London to the normal labour requirements of the port has been continued, but during the past year the Committee found it necessary slightly to augment the Register. The total number of Registered men on the 31st December, 1936, was 33,568, as against 33,407 at the end of the previous year.

Employment and Unemployment Position of Registered Port Workers

No system of securing individual records of employment has yet been devised for use in London, and it is therefore not possible to ascertain the total number of men actually employed each day. The approximate employment position of Registered Port Workers can, however, be estimated from the statistics relating to unemployment furnished by the Ministry of Labour. The following statement shows an appreciable reduction in the average unemployment of Registered men during the last three years, as compared with the average for the year 1931.

Monthly Average Unemployment of Registered Port Workers in London.

	1931	1934	1935	1936
January	7,291	5,289	4,919	3,605
February	7,126	6,064	5,919	4,863
March	8,582	6,558	6,666	6,058
April	6,163	6,581	6,812	6,083
May	7,372	7,565	5,719	5,680
June	8,031	6,809	6,043	5,261
July	7,898	5,797	5,439	4,775
August	7,334	5,877	5,682	5,072
September	6,964	5,732	5,812	4,683
October	7,610	5,778	4,794	4,404
November	5,748	5,152	4,113	3,475
December	4,681	3,970	3,879	3,187
Average figures for the 12 months.	7,967	5,931	5,483	4,762

Shortages of Registered Labour

When unregistered men have been employed their engagement has been largely due to the fact that sufficient Registered labour has not been available at the time and place required. Instances of the mal-adjustment between labour demand and supply occurred generally throughout the year 1936, but were particularly noticeable during the months of November and December.

The question is largely one of mobility, and the difficulty, on account of the size and geographical condition of the port, of transferring Port Workers from one point to another.

Telephone communication established between certain Port Workers' Offices in the "Up-Town" Area and the Royal Group of Docks, has relieved the situation to some extent, and, during the past year, enabled 2,778 supplementary engagements of Registered men to be effected at short notice which would otherwise probably have gone to unregistered workpeople.

An extension of this system, and the linking-up by telephone of all areas throughout the port, should greatly assist in reducing the number of Registered men unable to find employment at their normal "call" place.

Recruitment

During 1936 recruitment to the Register was confined in the main to the replacement of Port Workers whose Registrations had been cancelled for the following reasons:—

On account of:

(a) Sickness or accident (eligible for re-issue)	505
(b) Left Port work	672
(c) Transferred to Schedule II*	98
(d) Deceased	305
Total	1,580

The number of applications for Registration greatly exceeds the opportunities for recruitment, which continues to be strictly limited by the rules at present governing admission to the Register. Over 14,000 applications for Registration were received by the Committee during the year 1936. Of this number only 1,741 were finally accepted, and distributed as follows:—

(a) Licensed Lightermen	123
(b) Labour Boys upon reaching adult age	67
(c) Re-Issues	564
(d) Stevedores (Replacements)	130
(e) Transfers to Sons of Deceased or Incapacitated Registered Port Workers	225
(f) Transfers from Schedule II	41
(g) Other Special cases	591
Total	1,741

Surrey Commercial Docks

The unsatisfactory conditions prevailing at the Surrey Commercial Docks during "calling-on" times have caused the Committee considerable concern on account of the congestion and dislocation due to the attendance at the "calling-on" places of an excessive number of unregistered Port Workers during the timber season.

Despite efforts made by the Committee to ameliorate the position, there has been little or no improvement during the past year.

As a further experiment the Committee have agreed to recommend the institution of two daily "calls" only, at 7.45 a.m. and 12.45 p.m. This proposal involves the abolition of the additional "delayed" calls at 7.55 a.m. and 12.55 p.m. at present in operation, and will permit of the immediate engagement of other Registered men as soon as available Stevedores have been absorbed.

It is hoped that the experiment will shortly be brought into operation.

Conclusion

In concluding their report, the Committee desire to acknowledge the valuable co-operation of individual employers, Trade Union representatives, and their respective organisations. The assistance they have all rendered has been a material factor in promoting the aims and objects of the Registration Scheme.

It may well be, however, that the Scheme itself will probably require modification in certain respects if the progressive improvement of past years is to be maintained in the future. An important item at present under active consideration by the Committee is the possible division of the Port of London dock areas into separate districts for statistical purposes; also, the necessity for instituting some suitable system of obtaining records of employment in respect of individual Port Workers.

This report is signed by Messrs. W. L. Wrightson and T. W. Condon, Joint Chairmen, and also by the Secretary, Mr. W. E. Thomas.

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* Schedule II comprises supervisory and other Port Workers eligible for Registration following loss of their existing employment.

*Major Ports of British India**

System of Administration

By Sir THOMAS H. ELDERTON, Chairman, Calcutta Port Trust

The term " major port " in British India means a port the administration of which is supervised by the Government of India; all other ports are described as " minor " and are supervised by the Provincial Governments. As the Government of India has power to declare any port in British India to be a major port, it is quite possible for a major port to be of less importance than a minor one.

Calcutta Jetties.

For example, it became advisable for the Government of India to take over control of the Port of Vizagapatam during construction of the new harbour; and it was, therefore, declared to be a major port, although at the time its traffic was insignificant.

At the present time, however, the major ports include all ports in which facilities on any extensive scale have been provided for the loading and discharging of ocean-going vessels. These ports, taking them in order from the west, are Karachi, Bombay, Cochin, Madras, Vizagapatam, Calcutta and Chittagong. Some idea of their size and importance can be obtained from the following statement giving the total tonnage of seaborne traffic, imports and exports, which passed through each port during the financial year 1936-37:—

Karachi	2,086,346
Bombay	5,459,820
Cochin	(not available)
Madras	1,043,459
Vizagapatam	476,730
Calcutta	8,542,827
Chittagong (1935-36)	350,359

* Reproduced from The Financial Times India Supplement

The above figures may appear small compared with the traffic of over 38 millions tons which passed through the Port of London during 1935. But both the Bombay and Calcutta Port Trusts handle over their quays a greater tonnage than is handled over the quays belonging to the Port of London Authority. The portion of the port's traffic handled by the Bombay Port Trust is particularly large, being 93 per cent. of the total.

PORT TRUST'S CONTROL

Their Responsibilities

The ports of Karachi, Bombay, Madras and Calcutta are administered by Port Trusts, bodies specially constituted for the purpose with statutory powers to construct docks, jetties or other works which may be required for the general purposes of the port, including railways to serve the various parts of the Trust's premises. The Trusts are responsible for the handling of goods on their premises, but the work on board ships is done by private stevedores. Approaches to the ports are also maintained by the Trusts, an expensive duty in the case of Calcutta, where 120 miles of channels have to be surveyed, marked, buoyed and dredged.

These Port Trusts are somewhat similar to the Port of London Authority, but control at Chittagong is on the lines adopted at Southampton. The Chittagong Port Trust corresponds to the Southampton Harbour Board, and is only responsible for the approach channel and other external features constituting the harbour section of the port. Jetties and facilities for discharging and loading cargoes are provided and run by the Assam Bengal Railway in the same way as this portion of the work is done by the Southern Railway at Southampton.

Cochin and Vizagapatam are working under Administrative Officers who are directly under the control of the Government of India. But a Cochin Port Trust is likely to be formed within the next few years. It is believed that Vizagapatam will be similarly controlled as soon as this is possible.

STATUS OF CALCUTTA

Current Income

The Calcutta Port Trust is the oldest in India. Prior to 1868, there were no docks or jetties, and seagoing vessels had to lie at moorings in the river and work their cargoes into or from country boats, which in turn were unloaded over the banks of the river.

A start was made with the construction of four screw-pile T-headed jetties with cranes and sheds. These works were completed and the construction of two more jetties of the same type was started in 1869, a year before the present Port Trust was formed under the designation of the " Commissioners for Making Improvements in the Port of Calcutta." The floating block was handed over at its estimated current value and the shore works for what had actually been spent on their construction. The Commissioners' total debt to the Government amounted to Rs.27,65,000.

The Commissioners, immediately they took over, started to improve the facilities.

It is difficult to calculate the quantity of traffic handled by the Commissioners in those days, because the statistics only give the amount of income received from charges, which were based on weight, measurement or number of articles, and which varied considerably for different commodities. The total quantity, however, was certainly less than 100,000 tons—that is, less than one-sixtieth of the quantity of goods which now passes in a year over the Commissioners' jetties and quays.

The capital debt of the port now amounts to about 2,521 lakhs of rupees, or nearly £19,000,000, against which there is about Rs.492 lakhs in the sinking funds for the redemption of debenture loans, and about Rs.50 lakhs in reserve funds. Income for the current financial year is estimated at Rs.311½ lakhs and the expenditure of slightly less than Rs.310 lakhs.

Major Ports of British India—continued

BOMBAY-KARACHI-MADRAS

Present Positions

The Bombay Port Trust started in 1873 with a debt to the Government of over Rs.22 lakhs. The present debt amounts to about Rs.1,910 lakhs, or, roughly, £14½ millions, against which there is about Rs.493 lakhs in the sinking funds and over Rs.53 lakhs in reserve funds. Income for this year is estimated at about Rs.263 lakhs, despite reductions introduced at the beginning of the year, and the expenditure at about Rs.257 lakhs.

The Karachi and Madras Port Trusts were formed in 1886, and in both cases only took over liability for the small expenditure on port works previously incurred by the Government out of loans.

The present debt of the Karachi Port Trust is about Rs.403 lakhs, or roughly three million pounds, against which the sinking funds amount to over Rs.213 lakhs and reserve funds to nearly Rs.52 lakhs. Income and expenditure for this year are estimated at nearly Rs.71 lakhs.

Up-to-date figures for the Madras Port Trust are not available, but the capital debt is somewhere about Rs.150 lakhs, and income and expenditure are each slightly over Rs.30 lakhs per annum.

Calcutta: The River looking North. The Howrah Bridge and Jetties in the foreground on right.

PROS AND CONS

Co-ordination

Although the principle of autonomous administration of ports is now accepted in India, it can be applied only where a considerable amount of trade already exists and the port can be developed without increasing the charges to an extent which would cripple traffic.

For example, it would have been impossible to form a port trust at Vizagapatam and entrust it with the construction of the new harbour. Traffic was insignificant before the new harbour was opened, and even now consists mainly of manganese ore which cannot bear high charges. Income is only about a third of the expenditure, including interest on the capital expenditure, and many years must elapse before the port can be self-supporting. Till then, the Government must remain in control.

Another necessary condition to the successful working of a port trust is the existence of a trade centre of sufficient magnitude to ensure that suitable representatives of commerce are available to become trustees and direct the port's affairs.

Bombay and Calcutta, the two most important commercial centres in India, are particularly fortunate in this respect. For the leading commercial men, both Indian and European, have always been ready to serve on the port trusts and to direct affairs for the benefit of each port as a whole.

If these conditions are fulfilled, the great advantage of control by a port trust containing, as the Indian port trusts do, a majority of members representing commerce is that control is in the hands of those who have personal knowledge of the facilities required and of any defects in management. The fact that those in charge have to pay for services rendered in the form of rates and charges on vessels and goods is a check on extravagance.

The disadvantage of control by a Port Trust is the extent to which its finances are dependent upon the traffic of the port, and the difficulties which it may experience during prolonged periods of trade depression. The major portion of the income of most Port Trusts varies directly with the number of ships and quantity of goods using the port. While expenditure, apart from payments for labour, is practically unaffected by the quantity of trade. Interest and redemption charges have to be paid on the capital debt, and municipal taxes are constant. The property must be maintained in proper condition, and the work of dredging, surveying, marking and buoying the approaches to the harbour has to be maintained regardless of the number of ships entering the port.

Even in the matter of staff the number of men required, apart from dock labourers, only decreases slightly with a decline in trade. The effect of the decline is least in the case of the higher-paid staff.

This means that in times of prolonged depression a Port Trust, unless it has built up large reserve funds, must increase its charges when increases are most irksome. The building up of reserve funds by a Port Trust means some amount of self-restraint, as there is naturally a strong tendency when times are good and income is exceeding expenditure to reduce charges.

In spite of the disadvantage of autonomous control referred to above—a disadvantage which was experienced by all the ports during the recent trade depression—it has never been suggested that direct Government control would be preferable. Neither has it been suggested that railway control, as it exists in Chittagong, should be applied to other ports. The method may be suitable for Chittagong, but there are many reasons against its adoption in the larger ports. These reasons are particularly strong in the case of Bombay and Calcutta.

Until recently, the work of each Port Trust was supervised by its Provincial Government, but under the Reformed Constitution they have all come under the direct supervision of the Government of India since 1st April, 1937.

It has been urged that there is need in India for better co-ordination between the various branches of transport, and that there is now much wasteful competition. Linking of all ports with the Government of India should facilitate co-ordination. But it remains to be seen whether any practical benefit will be obtained.

Publications.

We have received an interesting leaflet describing a portable electric capstan manufactured by the Sadi Engineering Co., Ltd. The Sadi Capstan is intended to provide, in portable form, an electrically-driven appliance for all types of industry, and it is adaptable to the conditions of port work. The installation of suitable ground sockets makes it possible to have capstan facilities at many different points in an industrial organisation.

From H.M. Stationery Office there have been received copies of "Instructions as to Survey of Master's and Crew Spaces" (price 6d. net), and of "Nationality of Carrying Vessels" in Overseas Trade (price 1s. 0d. net). The latter also contains statistics on the value and proportion of imports, exports and re-exports of merchandise, in trade with principal countries of consignment, carried in British vessels and in vessels of other nationalities.

We have received from the Marine Department, Wellington, New Zealand, a copy of the Rules and Regulations concerning the design, construction, maintenance, inspection, testing and operation of power-driven cranes subject to the requirements of the Inspection of Machinery Act. The memorandum consists of 58 pages, and is divided into 3 sections, dealing with Power-driven Cranes, Overhead Travelling Cranes and Derrick Cranes and Travelling Jib Cranes.

Contrasts of Modern Shipping

Equipment, Harbour Facilities and Despatch

Under the above heading, the Baltic and International Conference Monthly Circular for September published an appeal to merchants and workmen engaged in quayside operations, which is timely and important. We venture, accordingly, to bring it to the notice of our readers. The article runs as follows:—

Developments on the freight markets of the world during the past 12 months have brought into strong relief some contrasts of modern shipping. Much energy and forethought on the part of shipbuilders, and no little expense as far as shipowners are concerned, are constantly devoted towards improving the construction and equipment of vessels. The object is, of course, to increase the speed and the facility with which cargoes can be carried, loaded and discharged. Wireless is provided, not only to serve the safety of vessels but to supply information as to their position.

All the more important ports—in particular those which cater for the same commercial and industrial customers—compete with each other to supply cranes and other facilities for the quickest possible turn-round of the vessels in port.

The consideration behind these constant endeavours is the obvious one that, as freight rates largely consist of the working cost of vessels, the shorter the time required for the carriage of a particular cargo, the cheaper the carriage must be.

No fault can be found—economically or practically—with this argument. The extraordinary thing is that there should be anybody who does not appreciate it, or, even more inconceivable, who directly work against it.

This is the contrast to which we refer in the heading to this article. If we turn to the other parties to the carriage of goods by sea, namely, merchants and the workmen, dockers and trimmers, employed in loading or discharging vessels, we find an altogether different attitude.

Merchants stipulate in charterparties daily quantities of a few hundred tons while vessels are constructed and harbour facilities available to handle as many thousand tons. Merchants make their influence felt in the fixing of customs and the enacting of maritime laws providing for so-called normal despatch which may sometimes have been normal despatch for sailing vessels a hundred years ago, but which bears no reasonable relation to modern conditions.

It might perhaps be held that vessels obtain better despatch than stipulated, and that the small daily quantities are a question of protecting merchants against paying demurrage if extraordinary, unforeseen circumstances should arise, or that merchants earn despatch money by saving time for the vessel. This is true in some but by no means in all cases. Even if it were, it would mean that owners must either calculate their freight rates to cover the stay in port as provided in the charterparty, or consider despatch money as a direct reduction in their freight rates. It is not necessary to be a professor of economics to realise that, in particular at the present time, the likelihood is that merchants might have to pay in the freight rate more than the protection against demurrage is worth to them, and certainly more than they earn in despatch money.

Then there is the question of notice time before the commencement of the loading or discharge. By stipulations in charterparties, by customs of the port, or according to maritime laws, merchans keep vessels idle for many hours, sometimes days, before loading or discharge is commenced. This was in order in the old days where the first notice of the arrival of the vessel was her appearance in port. But in our days with ample means at their disposal to keep themselves informed of the position of the vessel, there is no justification for not being ready to deliver or take delivery of cargoes on arrival of the vessel.

As regards the workmen, in one country after the other they strive to reduce the working hours, with prohibition against or with enormous cost of working overtime. Why not instead introduce shift work? The demand for goods and for tonnage to carry them is brisk; there is no prospect of lack of employment by giving vessels a quicker turn-round. At but little extra cost, representing a fraction only of the cost of the time saved, shift work would increase the number of men employed, add to the consumption of goods because more men had more money to spend, and directly counteract the increase in the cost of living by making the goods cheaper.

This consideration of some contradictory aspects of the freight situation would not be complete without reference to one respect in which a few British ports are found on the wrong side of modern developments, that is to say, the ports where on account of congestion timber-laden vessels are kept waiting day after day for their cargoes to be discharged. We are familiar with the arguments that the timber trade is a seasonal one, and that, being self-supporting, the ports can only provide facilities which it is possible to utilise fully and in an economic manner. But have the ports concerned made a proper calculation as to what it costs the commercial community at the present time to use vessels as floating warehouses?

It might be held by some—though, we think, in the long run mistakenly—that in difficult times a slow turn-round is of advantage to owners because it increases the demand for tonnage artificially. Even this argument is not available now, and to be consistent, vessels should be built accordingly, which no sane owner would consider doing even in the worst periods of depression.

Much would be gained by everybody, and by no means the least would be gained by the parties themselves if they would endeavour to move with the times, discard their old-fashioned and obsolete ideas and promote instead of handicap the smooth flow of trade.

We appeal to them to do so.

[The appearance of the above article evoked a considerable degree of interest, as indeed, might have been expected. In its succeeding issue, the Journal in question resumed the subject with an extension of its remarks bearing on the responsibilities of port authorities, and in particular in connection with the timber trade. The following is a further extract]:—

As to our remarks concerning the necessity for quicker despatch of ships discharging timber in U.K. ports, fear has been expressed in British papers that improvements of port facilities in U.K. for a seasonal trade like the timber trade might be so expensive to shipowners themselves, through increase of dock dues and other charges that it might not be considered economically desirable to introduce such improvements. It is difficult to say to what extent such fears are justified. It will depend upon local conditions and expenditures required. At some places they need not be prohibitive as the installation of a few modern cranes, new railway sidings, or even only a slight adjustment in the charge for storing timber on the quays should have the desired effect. Recent developments indicate that shipowners have been right in continuing to put forward their criticism. Since the introduction of the "Baltwhite Timber Scheme" several U.K. timber ports have been subjected to extra freight rates to cover the risk of detention through congestion. This has revealed to dock authorities and importers the drawback of the ports not being capable to deal efficiently with the usual imports, and it has caused several ports to put work in hand for improving the discharging facilities for timber.

In this connection it is remarkable also that some U.K. ports have realised the danger they incur from the competition of other ports. This is an old phenomena on the Continent, where such ports as Havre, Dieppe, Dunkirk, Antwerp, Rotterdam, Amsterdam, Bremen and Hamburg have been competing for many years, all realising the importance of making their port attractive to owners. Whether they have actually made all the improvements desirable, is another question, that we shall not touch upon here, but we cannot refrain from mentioning what is said in a leading article of the "Lloyd Anversois" on the day, October 1st, when the 40 hours week was introduced in the Port of Antwerp: "We also have in mind the modernisation of our equipment (replacement of hydraulic cranes by electric engines, etc.), construction on the quay of warehouses for generals and so forth. Last but not least, we keep in mind the numerous efforts that private initiative cannot omit making in order to maintain our place under the sun: an effective collaboration with the international organisations of the shipowners with a view to the revision of charterparties, modernisation of equipment, etc."

It would seem that the author of this article has grasped the problem fully and shipowners are now awaiting developments, in Antwerp as well as in U.K. and elsewhere.

The Institute of Transport Examinations, 1938

The Institute of Transport announces that the next examinations for graduateship and associate membership will be held on April 28th, 29th and 30th, 1938, in London and at a number of provincial and overseas centres. Among the subjects are Port and Inland Water Transport.

Full particulars of the examinations, previous question papers (price 1s. per set, post free) and copies of a revised and enlarged edition of a booklet entitled "The Institute of Transport Examinations; notes for the guidance of candidates unable to attend preparatory courses" (price 2s. 6d., post free) may be had on application to 'The Secretary, The Institute of Transport, 15, Savoy Street, W.C.2." The closing date for the receipt of applications to sit for the examinations is March 1st, 1938. Prospective candidates are advised to confirm, as soon as possible, their eligibility to sit for the examinations they have in view, and this they may do by communicating with the Secretary of the Institute.

South Jersey (U.S.A.) Port Commission

Excerpts from Report for the Year 1936

Shipping through South Jersey ports was greater in 1936 than in any previous year. The volume of tonnage handled at the Camden Marine Terminals, operated by your Commission, showed an increase in the past year of approximately twenty-one per cent. over the 1935 tonnage. The increase would have been greater had there been no seamen's strike to interfere with intercoastal shipments in the last two months of the year.

A decade has passed since the Legislature, acting upon the Governor's recommendation and after a thorough survey and report by a special commission, created The South Jersey Port District embracing the seven tidewater counties bordering on the Delaware River and Bay. The South Jersey Port Commission was appointed at the same time to exercise the authority of the District, to construct and operate marine terminals, and to foster and protect industry and commerce. It may not be inappropriate to recall the conditions prompting this legislative action, and to review the accomplishments of the past ten years.

New Jersey has a more extensive frontage on the Delaware River and Bay than any other State. But this great asset had been neglected and the South Jersey manufacturers and shippers were seriously handicapped by lack of adequate, modern facilities for receiving materials and shipping their products by water, which is the cheapest method of transportation.

While the City of Philadelphia had expended upward of forty millions of dollars in providing wharves and docks and thus served a great and growing commerce with all countries, and Wilmington, Delaware, had constructed a public terminal and thereby added to its industries, there was no such improvement along the Jersey shore. Our shippers, being without local terminal facilities and regular ship service, had to pay toll to the other side of the river and were at a disadvantage in the competitive struggle for business.

Camden, with its large and diversified industries, felt the need of port development and, taking advantage of the Port District act, agreed to finance the construction of a marine terminal. Trenton, ambitious to become a seaport but handicapped by an inadequate channel, renewed, with the Port Commission's aid, its fight for Federal funds, having pledged itself to build an adequate terminal.

These movements, in co-operation with the Federal authorities, have brought about the creation of facilities for water-borne traffic which South Jersey shippers required. The Port of Camden is now equipped with a terminal not only adequately serving its commerce, but planned as well for its future needs. Trenton has become a seaport, the Federal Government having expended over eight million dollars in dredging to provide a channel depth of twenty-five feet at mean low water. The public terminals at Camden and Trenton have already effected savings in transportation costs to New Jersey shippers, which justify the capital investments.

A comprehensive survey of water-borne commerce of the South Jersey Port District for the year 1935, was made in 1936 by the Port Commission's Traffic Bureau. This survey disclosed that the total water-borne commerce in the District during 1935 amounted to 5,126,950 tons, valued at $91,315,078, an increase of 14.3 per cent. in volume, as compared with 1934.

In 1934, according to the annual survey made by the Traffic Bureau, the total tonnage movement was 4,486,202 tons with an estimated value of $75,925,168.

The largest percentage of increase in tonnage movement during 1935 occurred at the Port of Trenton, where the growth in outbound and inbound cargoes amounted to 25.55 per cent. This expansion in water-borne commerce at the Port of Trenton indicates the increased shipping activity brought about by the operation of the Trenton municipal terminals, with the greater channel depth in the Delaware River above Camden which has been provided by the Federal Government.

The total commerce for the Port of Camden, including Camden Marine Terminals, Cooper River, Petty's Island and Gloucester City, N.J., amounted to 1,468,337 tons, valued at $30,818,395, an increase of 13.38 per cent. in tonnage movement over 1934.

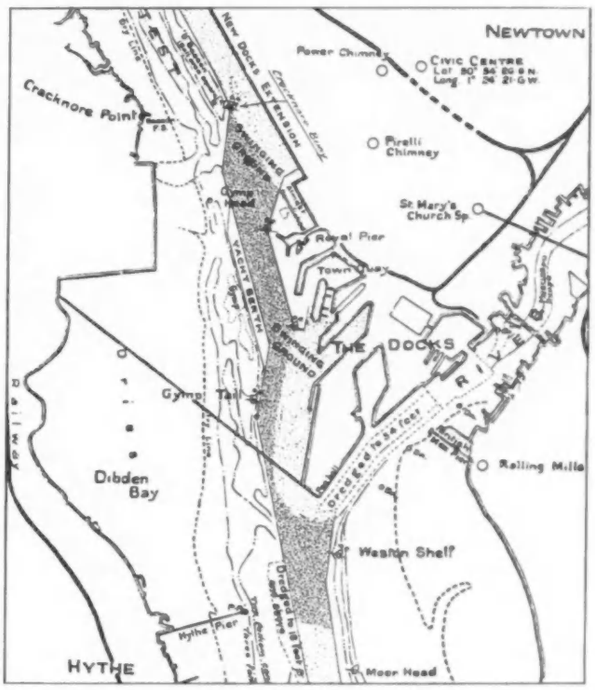
The total commerce movement from all points on the Delaware River, other than the ports of Camden and Trenton, amounted to 3,084,981 tons, valued at $47,794,227, an increase of 13.2 per cent. in volume, as compared with 1934.

The shipping activity in the tributary streams in the South Jersey Port District during 1935 showed an increase of 21.7 per cent. over 1934. The total commerce on the tributary streams, other than Rancocas and Cooper rivers, amounted to 395,835 tons, valued at $5,013,770.

The special thanks of the Institution of Civil Engineers have been given to Mr. Raymond Carpmael, O.B.E., for his Paper on " The Maintenance of Waterways to Harbours and Docks," since as a member of the Council, he is ineligible to receive an award.

Southampton Harbour Dredging

In the September issue, it was announced that the Southampton Harbour Board had decided to deepen a section of the approach channel to the Southampton Quays at an estimated cost of £76,000. For this purpose they have entered into an arrangement with the James Dredging Towage and Transport Co., Ltd., who have previously carried out dredging contracts for the Board.



Through the courtesy of the Hydrographic Surveyor to the Board (Capt. D. H. Macmillan), we are able to reproduce on this page a plan, showing the extent of the area to be dredged. It is an area for which the Board is responsible as to maintenance, and it is to be deepened to a minimum level of 36-ft. below Port Low Water Datum, which is defined as 6.75-ft. below Ordnance Datum (Liverpool), or 4.78-ft. below Newlyn Datum.

On the Admiralty charts the area is shown as having an official depth of 35-ft. below Datum.

The material to be removed is for the most part soft, alluvial mud.

Foreign Publications

Ricerche sulle Caratteristiche del Moto Ondoso nel Mediterraneo e sulla Teoria del Cornaglia. By Dott. Ing. Agatino D'Arrigo. Rome, 1937.

This monograph, reprinted from the Annali dei Lavori Pubblici, examines the conclusions formulated in the Section on Maritime Navigation of the XVIth International Congress of Navigation held at Brussels in 1935, in regard to the characteristics of wave motion in the Mediterranean, with the correlative technical problems on breakwaters of the vertical wall type and with the theory of Cornaglia. The correlation of the Stevenson wave is investigated, so as to reconstruct the curve of height of storm waves in accordance with the state of actual knowledge. Periodic analysis is applied to the wave motion observed at Catania, not excepting the storms of 1930 and 1933, which were the most memorable reported in the Mediterranean region.

Carta Batilitologica della Piattaforma Litorale Italiana con Cenni Illustrativi, a cura dell 'Ing. Luigi Manfredonia, Presidente della Commissione di Studi sul Regime dei Litorali del Regno. Rome, 1937.

Opening with the startling affirmation that on physical and geographical considerations, Italy is essentially an island, the memoir sets out the " coefficient of insularity " of Italy, and passing in review the progress in Italian marine cartography, puts in evidence the importance of bathilithological charts for the scientific and practical purposes of utilisation in connection with various objects—litoral regimen, harbour works, coast defence, drainage, navigation, fishery, etc.—and illustrates the criteria on which the general chart has been prepared, the first published in Italy, and comprising the entire litoral platform. The chart is in three sections, with contour lines and depth levels in colour.

Foreign Publications—continued

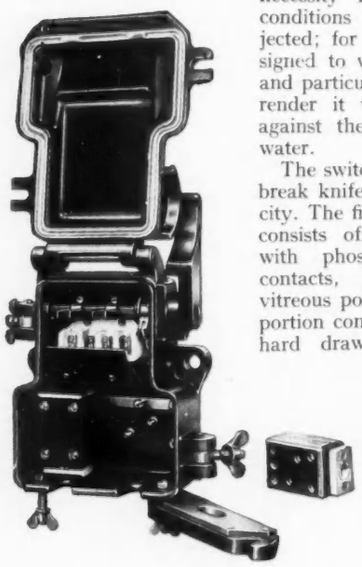
I Porti, by Prof. Dr. Ing. E. Coen Cagli, Rome, 1937.

This is a reprint of an article in the volume recently published by the Reale Accademia Nazionale dei Lincei, entitled Dal Regno all' Impero. It is a review of the development since 1861 of Italian ports, of which at the inauguration of the kingdom of Italy, including provinces subsequently annexed, there were not less than 315 engaged in commerce, 57 being of national importance and 258 of local interest. The whole of these ports, however, in the aggregate, did not provide more than 6,500 lin. metres of quayage, and had very inadequate cargo-handling equipment. The subsequent record shows that 85 ports have been more or less radically transformed, enlarged or improved; 48 kilometres (30 miles) of harbour defence works have been constructed to protect more than 1,000 hectares (2,400 acres) of new port basins; and 52 kilometres (32 miles) of new quayage have been provided with over 250 new mechanical appliances of various capacities for handling goods.

The Journal de la Marine Marchande has published a useful compendium of information on French ports, under the title of Les Ports Français. It is issued in connection with the International Exhibition of 1937, and commences with two articles: the first on L'Association des Grands Ports Français, and the second on Le Role d'une Chambre de Commerce Maritime. Thereafter, the ports are grouped under the headings: (1) The North Sea and the Channel; (2) France on the Rhine; (3) The Atlantic; (4) the Mediterranean; and (5) North Africa. The respective notices of these ports are contributed by officials associated with their exploitation and operation. There is a considerable amount of very useful statistical, historical and descriptive information, accompanied by a number of plans and photographic illustrations. The price is 30 francs.

A New Cargo Connection Box

For controlling portable cargo lanterns on board ship a new connection box unit has been introduced by The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2. In designing this box, particular attention has been given to the necessity for meeting the arduous conditions to which it will be subjected; for instance, it has been designed to withstand rough handling, and particular care has been taken to render it water-tight and to guard against the corrosive effects of salt water.



The switch is a double pole, double break knife switch of 20-amps. capacity. The fixed contacts and terminals consists of substantial brass blocks with phosphor bronze embracing contacts, mounted on a strong vitreous porcelain base. The moving portion consists of two " U "-shaped hard drawn copper blades firmly secured to a micanised steel shaft and the movement is of the quick make, quick break quick make, quick break type. This switch controls two separate plugs to which the portables are wired.

The fixed portion of the plug circuits consists of hard drawn brass pins which are fixed to an ebony Sindanyo base. The removeable plugs are lignum vitæ blocks containing the brass sockets which engage the fixed pins in the switch box; this arrangement dispenses with projecting pins on the plugs, which would sustain damage when they are thrown about. A suitable cable grip is provided in the ends of the plugs.

The whole interior is contained in a strong cast iron box, and when the plugs are not in use the end of the box is closed with a hinged plate making the unit water-tight. Earthing is provided by means of substantial earth pins (connected to a common earth bar) in the switch box and an earth socket in each plug, which makes contact with the earth pin before the circuit pins and sockets become engaged. The operating handle of the switch is inter-locked with the cover of the switch box so that the cover can be opened only when the switch is in the " off " position. This ensures that the plugs cannot be inserted or withdrawn when the circuits are alive. The boxes fully comply with the requirements of the Home Office for use on board ship or in factories.

Retirement of Port Official

Mr. Richard Aughton, M.Inst.T., retired last month from his position as General Manager of the Tyne Commission, having reached the age limit. A native of Liverpool, Mr. Aughton had been 30 years in the service of the Mersey Docks and Harbour Board before joining the Tyne Commission as assistant to Mr. J. McDonald Manson, at that time General Manager and Secretary. On Mr. Manson's retirement Mr. Aughton was appointed General Manager. In addition to many other activities, Mr. Aughton was for six years Hon. Secretary of the Tyneside Industrial Development Conference. He has also been a member of the Council of Newcastle Chamber of Commerce. He was chairman of the Newcastle and District Branch of the Institute of Transport from 1928 to 1931 and has also served on the Council of the Institute. He carries with him into his retirement the good wishes of a large circle of friends.

Madras Port Trust

Excerpts from Administration Report for 1936-37

General.—There was an appreciable improvement in the volume of export trade passing through the port during the year under review especially of cotton and groundnuts. There was a slight fall in the imports of oil and coal. As compared with previous years, there was a slight decrease in the imports of rice during the year.

Receipts.—The Board's actual revenue receipts for the year under review amounted to Rs. 30,40,918, an increase of Rs. 44,735 as compared with those of the previous year which amounted to Rs. 29,96,183 excluding the sum of Rs. 1,50,000 contributed from the Madras Port Fund during the previous year.

Working Expenses.—The gross expenditure of the year was Rs. 31,66,500 as compared with Rs. 32,05,921 of the previous year. Excluding from the gross expenditure, the interest on loans which amounted in the year to Rs. 7,65,391, contribution to Reserve Funds, Rs. 4,34,125, repayment of debt, Rs. 1,49,967, Sinking Fund, Rs. 77,596 and contribution to Capital Account, Rs. 21,200, the actual working expenses came to 56.50% of the income as against 53.69% in the previous year.

Sinking Fund.—A sum of Rs. 77,596 was contributed during the year towards the sinking fund for the repayment of the Sterling Loan of £330,000 raised in the London market in 1923. The total amount of securities that stood to the credit of the sinking fund at the end of the year was £108,150 19s. 10d.

Imports and Exports.—The total tonnage of imports and exports which passed through the harbour during the year under review was 1,012,857 tons or a fall of 0.66% from the previous year, the tonnage for the previous six years being 1,019,560 tons in 1935-36; 1,158,876 tons in 1934-35; 1,009,192 tons in 1933-34; 1,010,890 tons in 1932-33; 1,155,748 tons in 1931-32; and 1,262,407 tons in 1930-31.

Hydrographical Observations.—Observations taken during the year under review show that the waters bounding the approaches and entrance to the harbour continue to deteriorate. An attempt was made at dredging outside the harbour during the change-over of monsoon in September, 1936, but the results were not very satisfactory owing to a heavy ground swell running at the time

Shipping.—The number of vessels that entered the harbour during 1936-37 was 708 as against 697 in the previous year and the total net registered tonnage increased from 2,441,739 to 2,540,911. The average tonnage of each steamer or motor vessel increased from 3,661.68 to 3,674.77 registered tons.

The Report was signed by Mr. G. G. Armstrong, Chairman, Madras Port Trust.

Port Improvements at Salonika.

During recent years, there has been an appreciable increase of traffic at the Port of Salonika (or Thessaloniki), so that considerable inconvenience and delays have resulted. A comprehensive scheme of public works has been drawn up by the Greek Government, including port improvements at Thessaloniki. The programme provides for the construction of 1¾ miles of quayage, a long breakwater, and the excavation of new anchorages behind it, so that ships of greater tonnage can be accommodated.